Satellite Network Operations for the California Regional PM_{10} /$PM_{2.5}$ Air Quality Study (CRPAQS)

DRAFT Final Report

Prepared for:

San Joaquin Valleywide Study Agency
and California Air Resources Board

Prepared by:

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Santa Rosa, CA

and

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100 West Walnut Street
Pasadena, CA

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Disclaimer

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We wish to acknowledge the contribution and cooperation of many scientists who made the success of this study possible. Ms. Karen Magliano of ARB provided the overall study management and critical coordination between participants. Mr. James Sweet of the SJVUAPCD and Dr. John Watson of DRI, whom are both thoroughly familiar with the excessive particulate issues of concern in the study area, provided overall technical guidance and were principle in providing network design. Dr. Willard Richards is gratefully acknowledged for having recommended and provided affordable nephelometer instrumentation that met functional expectations and allowed the study to be carried out as planned and within budget. Dr. Richards also developed the nephelometer data validation procedures used herein. Dr. Charles McDade of ENSR, and Mr. David Wright of PCR located and configured the sites in the network with power and instrument mounting hardware.

As is also typical with field studies, field manpower was allocated assuming that all would go according to plan, which is rarely the case. Through their perseverance to overcome many obstacles, T&B Systems field personnel Messer's William Knuth, Derek Lehrman, Robert Hillestad, Joe Neumann, Vince Herrera and Dr. William Keifer, along with Parsons field personnel Messer's Robert Baxter, David Yoho, Robert LaBlanc, and Lou Villaruz successfully completed the field measurements within budget. The field crew is very thankful to Ms. Barbara Hinsvark of DRI who "kept the filters coming" in spite of difficult logistics and obstacles to hurdle. Thanks to Kristi Thach who provided assistance in the Parsons office. We, also, thank Mr. Don Cobb and Roger Tree of ARS for sharing their calibration expertise with our field crew.

In addition to T&B Systems and Parsons personnel, we received excellent local support from those who operated remote sites; specifically, Katy Warner and Kyle Kline of the National Park Service at Yosemite, and Dan Johnson of the Great Basin APCD who assisted at Olancha. There where also those who provided access to and assistance at various locations: Mr. Peter Conners and Will Newman at Bodega Bay; Tom Conwell at Bethal Island and vicinity; Gary Zappo at Livermore; Bob Schustritsch in the San Francisco Bay Area; Anthony Larsen at San Jose; and Stan Yamaichi and Evan Shippe for their general assistance with site coordination.

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TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The California Regional PM_{10}/$PM_{2.5}$ Air Quality Study (CRPAQS) was implemented to improve scientific understanding of excessive particulate matter (PM) levels in central California. Specifically, this understanding is needed to determine where and when populations experience excessive exposures, as defined by National Ambient Air Quality Standards (NAAQS) and State Air Quality Standards, and how to cost-effectively reduce those exposures to acceptable levels. The project is sponsored by the San Joaquin Valleywide Air Pollution Study Agency (JPA), and administered by the California Air Resources Board (ARB).

Technical and Business Systems (T&B Systems) and their teaming partners, Parsons ES (PES) and Air Resources Specialists (ARS), were contracted to establish and operate a network of monitoring sites for the Satellite Network element of the CRPAQS that produces a comprehensive database of a known quality. This element of field program consisted of the following measurements:

- Particle mass (PM) loading
- Light scattering by aerosols (b_{sp})
- Hydrocarbon (HC) sampling, and
- Upper-air meteorology (Rawinsonde)

The Satellite Network field data acquisition portion of the CRPAQS Program took place over a 14-month period from December 1999 to February 2001. The Project consisted of the three major elements: An Annual program which encompassed the entire period, a Fall Saturation study, and a Winter study (2000-2001) which consisted of periods during which intensive measurements were made. As part of the Annual Network, a number of sites were added in transport corridors to the Mojave Desert during the summer months when those areas historically experience peak PM loading.

The objective of the Annual Program element was to operate a field measurement network of sufficient scope so that the spatial and temporal characteristics of particulate loading and visibility variation in the project area could be more completely understood. The project domain included the entire San Joaquin Valley, the southern portion of the Sacramento Valley, the Bay/Delta area, the Sierra Nevada foothills, and the desert area south and east of southern San Joaquin Valley. PM_{10} and $PM_{2.5}$ mass were measured on an every sixth day schedule at as many as 44 sites in the project area for the 14-month period that translated to a total of 72 sampling days. Summa canisters, integrated over 24-hours and exposed on the same schedule as PM, were analyzed for ambient levels of hydrocarbons at three sites. Nephelometers measuring light scatter were operated continuously at as many as 30 locations distributed throughout the project domain.

The Fall Saturation Program was a special monitoring campaign that was designed to provide a comprehensive database to determine the relative contributions to PM_{10} from agricultural activities in a dense network of receptors (26) in order to evaluate potential control strategies. In addition, the results of this study will be used in combination with the Annual Network results to evaluate integrated control strategies for both spatial scales. The area chosen for the project was in and around the town of Corcoran, in the southern San Joaquin Valley. The study area is affected by intensive cotton harvesting and processing activity during the early fall months, thus providing an excellent study opportunity. Nephelometers were operated continuously at 24 sites, and PM_{10} filter sampling was conducted daily at 11 sites.

The Winter program took place from December 1, 2000 to February 6, 2001. The objective of the Winter program was to provide intensified measurements of $PM_{2.5}$ and b_{sp} during periods of high PM loading in the Annual study region, emphasizing the areas around the Anchor sites in the San Joaquin Valley and Bay/Delta area. For this campaign, 16 additional nephelometer sites were added to the Annual network. Filter sampling was run on consecutive days at 25 selected Annual network sites on 15 high particulate episode days. HC sampling was similarly conducted daily at one site. In addition, T&B Systems made balloon-borne soundings of temperature, humidity and winds aloft at Fresno and Bakersfield during episodes. All additional Winter study monitoring and sampling was coordinated with the ongoing Annual program data acquisition operations.

Particulate mass was measured using Airmetrics MiniVol filter samplers. A variety of filter configurations, specific to each site location, were exposed for 24-hours providing daily integrated measurements. The Desert Research Institute (DRI) in Reno, NV prepared and analyzed the filter samples for particle mass loading and chemical speciation. Nephelometers, manufactured by Radiance Research, were utilized to continuously monitor the light scattering extinction coefficient (b_{sp}). T&B Systems and PES field technicians routinely downloaded nephelometer data and changed filter samples at the Satellite sites on a regularly scheduled basis during the 14-month field-monitoring program. Hydrocarbon (HC) samplers were provided by the Oregon Graduate Institute (OGI) who also prepared and conducted laboratory analyses of the exposed canister. HC sampling was conducted on the same schedule as the $PM_{2.5}$ filter sampling.

T&B Systems also actively participated in the program planning process, instrument selection and instrument acceptance testing. A Quality Assurance Program, consisting of internal Standard Operating Procedures (SOP), equipment calibrations and both independent and external audits, was developed and implemented.

This report is an adjunct to an electronic data set containing validated nephelometer data that has been submitted to the CRPAQS Data Manager, and filter sampler flow rates submitted to the Desert Research Institute (DRI) Laboratory Analysis Manager. The latter data set also appears in tabular form in appendices of this document. A description of the project setting and operations is provided herein, as well as vital information for the database user, such as specific site locations, operational milestones, calibration and audit results, and data validation procedures. Additional information and/or clarification can be obtained from T&B Systems.

Following this introduction, Section 2 of the report presents a description of the instrumentation used in the Satellite Network. Sections 3 through 5 provide detailed information on the Annual, Fall, and Winter programs, respectively. Section 6 presents the quality assurance procedures used to optimize the data capture and document the validity of the data collected. Section 7 describes data processing validation methodology.

The appendices of this report contain examples of the SOPs and documentation forms used in the project and a number of lengthy tables containing important information that is too voluminous to include in the main text of this document.

2. INSTRUMENTATION

Aerosol mass and characteristics were measured in the CRPAQS Satellite Network Program using two distinctly different methodologies. PM mass measurements were made with portable MiniVol samplers manufactured by Airmetrics of Springfield, Oregon, and furnished by Desert Research Institute (DRI). MiniVol sampling produces a time-integrated sample (24 hrs for this project) of filter-captured particles, which were measured for total mass and chemically analyzed in a laboratory environment at DRI. Light-scattering for the program was monitored with the M903 Integrating Nephelometer manufactured by Radiance Research of Seattle, WA. This instrumentation system electronically measures light-scattering from airborne aerosols and small particles continuously and internally records the information. In this study, the nephelometers were programmed to provide 5-minute averaged data.

T&B Systems also operated hydrocarbon (HC) samplers at three locations as elements of the Annual Satellite Network and Winter Satellite sampling.

In addition, meteorological measurement systems were utilized during CRPAQS. Upper-air balloon soundings (Rawinsondes) were taken by T&B Systems at Fresno and Bakersfield during the Winter Program. In addition, a National Weather Service contractor made extra upper air soundings at Oakland.

2.1 MiniVol Filter Samplers

The Airmetrics MiniVol samplers collect suspended particulate matter on filter substrates suitable for measurement of aerosol mass and various chemical analyses. Sampler air is drawn in through a size-selective inlet (SSI). The sampler is operated by a rechargeable battery and can be programmed to begin and end sampling at predetermined times. **Figure 2-1** presents a diagram of the MiniVol sampler.

The MiniVol sampler SSI operated using impactors with either a 5- or 10-µm diameter particle cut point and a flow control system capable of maintaining a constant flow rate within the design specifications of the inlet. The impactor is designed for 50 percent collection efficiency for particles of aerodynamic diameter of 10 µm or less at a nominal flow rate of 5.0 lpm. The inlet tube conducts air to a twin cylinder diaphragm pump. From the pump, air is forced through a standard rotameter (0-10 l/minute) where it is exhausted to the atmosphere inside the sampler housing. An elapsed-time meter is used to record the time the sampler is operated within the flow and voltage specification. The sampler is equipped with a circuit that automatically turns the sampler off if the batteries fail to supply sufficient voltage to the pump. A similar circuit is used to shut down sampling if a minimum flow rate cannot be maintained at a preset specification (this minimum flow rate was set at 4.0 lpm for this project.)

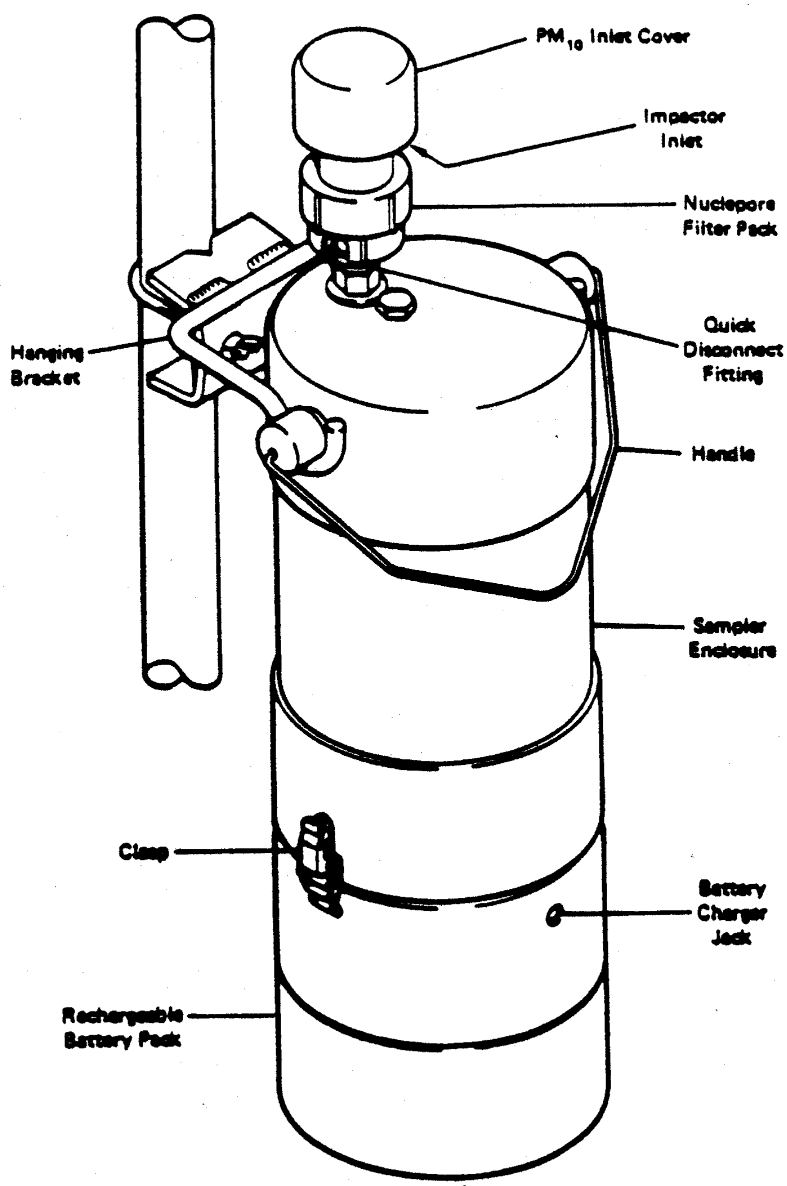


Figure 2-1. Diagram of the Portable MiniVol Sampler (Source: DRI)

The PM samples were collected on numbered filter packs in Nuclepore polycarbonate filter holders. Each filter pack was loaded with a pre-weighed 47 mm diameter Gelman PTFE Teflon membrane filter. The Teflon membrane removed particles for measurement of particle mass by gravimetric analysis, visibility by light absorption, elements by x-ray fluorescence analysis, chloride, nitrate and sulfate by ion chromatography, potassium and sodium by atomic absorption spectrophotometry, and ammonium by automated colorimetry.

The flow rate was recorded from the sampler rotameter at the beginning and end of each 24-hour sampling period. The sample volume was calculated from the average of the beginning and ending flow rates, and the sample duration.

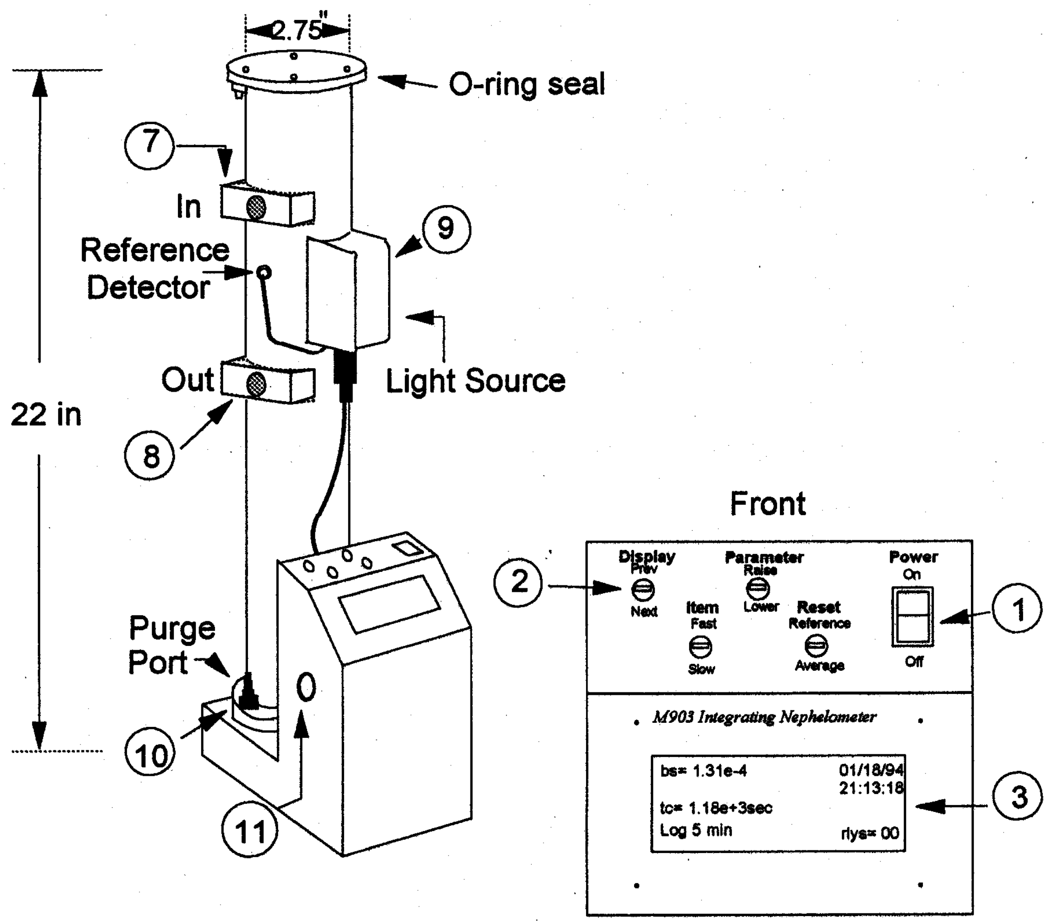
2.2 Radiance Research Nephelometer

The Radiance Research Model 903 Nephelometer measures light-scattering in an airflow that passes through the scattering chamber of the instrument. The instrument measures the light-scattering extinction coefficient (b_{sp}) using the geometry of a standard integrating nephelometer. Internal pressure and temperature sensors automatically correct for changes in air Rayleigh scattering. Relative humidity (RH) also is monitored and recorded.

The light source is a variable rate flashlamp with a wavelength defining optical filter (530 mm). The optical and electrical background noise is sufficiently low to allow measurement of b_{sp} (for particles) from less than 10 percent of Rayleigh Scattering (<.001 km^{-1}) to greater than 1 km^{-1}. The electronics were computer based, providing flexible menu-driven programming of the instrument operation using panel display/switches. Data averages (5 minutes) were stored internally in non-volatile RAM and retrieved in the field at regular intervals using a portable computer. **Figure 2-2** depicts the external features of the M903 Nephelometer.

Absorbed water interferes with light-scattering by the sampled particles. To mitigate this problem, the nephelometers were retrofitted with an inlet air heater that conditioned the sample air stream to a relative humidity nominally less than 70 percent. Maintaining relative humidity below 70 percent tends to minimize the effects of absorbed water in the sampled aerosol particles. Both AC and DC power based units were used on this project. The RH heaters only “conditioned” the sample air when the incoming ambient air was measured to be greater than 70 percent RH. The heater controller was connected to the RH sensor of the nephelometer, which sensed the air exiting the sampling chamber. Dr. Willard Richards supplied the heating units and AC electronic controllers. Mr. Alan Waggoner, of Waggoner Engineering, provided DC controllers.

A special environmental shelter was developed to house the nephelometers (see **Figure 2-3).** Dr. Richards also provided the shelters. Sample air enters the shelter through a screen-covered hole in the floor of the shelter and is conducted to the top of the shelter by a 2-inch diameter ABS plastic pipe. Sample air is exhausted from the shelter through a screened opening in the floor of the shelter by a ventilating fan rated



Identifying Parts

1. Power switch
2. Switches to change display modes and operating parameters used in conjunction with panel display.
3. 20 x 4 back lighted panel display.
4. Analog outputs - DB9p connector - pins 1-4 outputs (0-5 vdc), pins 6-9 grounds.
5. Serial connector - DB9s connector (direct PC connection).
6. Power connector - 5.5 mm OD, 2.1 mm ID, center positive VDC).
7. Aerosol inlet - Threaded 1/2 inch NPT.
8. Outlet - Vacuum source, threaded 1/2 inch NPT.
9. Flash lamp assembly - flash lamp and flash lamp circuit board are installed in aluminum cover.
10. Purge port - used for clean air and span gas sources.

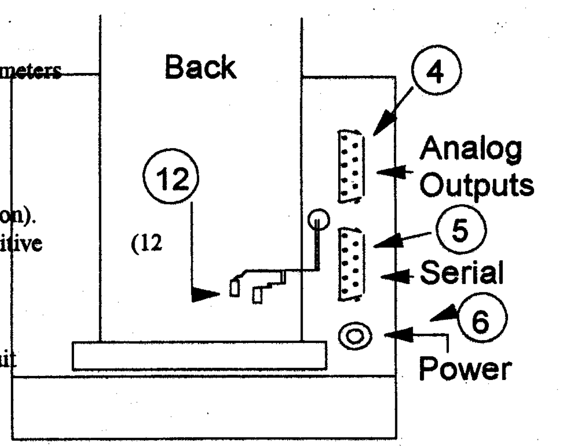


Figure 2-2. M903 Integrating Nephelometer – Rh Sensor Version

Enclosure with front cover

Figure 2-3. Environmental Enclosure with Nephelometer Installed

at 32 cfm. The inside volume of the shelter is approximately 2.5 ft^3. If the flow impedance caused by the screens reduces the airflow through the shelter to half the nominal flow (16 cfm), the air turnover time is about 1/6 min or 10 sec.

Nephelometer calibrations were carried out both in the field and in a laboratory using a specially designed flow control system, which can provide both zero air and span gas sample air to the instrument. The calibration system was provided by Air Resource Specialists, Inc. (ARS) of Boulder, Colorado. The span gas used for the calibrations was Freon 134a.

2.3 Hydrocarbon Sampler

The hydrocarbon sampler was designed and provided by Rei Rasmussen at OGI. Ambient air was drawn into a 6-liter summa canister under a precisely controlled flow rate. Canisters were cleaned and evacuated in the OGI laboratory prior to deployment to the field. During a 24-hour exposure to ambient air, the canister was pressurized to more than 20 psi. The hydrocarbon sampler apparatus was programmed using a Chrontrol® unit and operated using AC hookup with 9 v battery backup. Twenty-four hour integrated samples were taken during the CRPAQS Annual Satellite Program, and 6-hour samples during the Winter Program.

2.4 Rawinsonde Equipment

Rawinsonde systems consist of a balloon-borne expendable instrument package (sonde) containing meteorological sensors that measure vertical profiles of atmospheric pressure, temperature and moisture as the balloon ascends. Information measured by the sonde is transmitted by radio to a ground-based receiver that converts the signal into digitized form through a computerized data acquisition system. The meteorological data received from the radiosonde at the base station become what is commonly called rawinsonde data when wind speed and wind direction data are determined at vertical increments along with the other meteorological parameters.

The measurement of pressure, temperature and humidity (PTU data) in this manner has become quite standardized and therefore there is very little difference among various types and manufacturers. Winds aloft measurements, on the other hand, vary more because of differences in methodology. Winds aloft are determined during rawinsonde ascents by measuring the position of the radiosonde relative to the earth's surface at discrete time intervals. By measuring the position of the balloon with respect to time and altitude, wind vectors can be computed that represent the layer-averaged horizontal wind speed and wind direction for successive layers. The position data are usually obtained either by tracking the radiosonde from a fixed ground station using radio direction finding (RDF) techniques, or by using one of the radio navigation (navaid) networks such as Loran-C. Both navaid and RDF-type systems were used in the CRPAQS Program.

Navaid-type sounding systems were used at Fresno and Bakersfield. The rawinsonde system used was the ZEEMET W-9000 made by the VIZ Manufacturing Company of Philadelphia, PA.

The rawinsonde system operating at the Oakland NWS site is the RDF type Micro-ART systems which utilize radio theodolite (RT) tracking. The Micro-ART ground units are commonly used throughout the NWS. The radiosonde used in conjunction with the Micro-ART receiver/tracker is the VIZ 1392 B sonde from VIZ Manufacturing.

3. ANNUAL PROGRAM

The keystone of the CRPAQS Satellite Network Program was the long-term field measurements campaign known as the Annual Program. The field data acquisition portion of the Annual Program ran from December 1999 to February 2001. The Annual Satellite Network consisted of an array of sites monitoring $PM_{2.5}$ and PM_{10} using filter samplers, and the backscatter of light from particulates (b_{sp}) using nephelometers. Monitoring sites ranged from Bodega Bay and Pleasant Grove in the north to the Mojave Desert (Barstow) in the south. The Satellite measurements were intended to supplement an 'Anchor' and 'Backbone' network of sites where a more comprehensive set of measurements were made. T&B Systems was responsible for installing and operating the Annual Satellite Network, processing the resultant database, and implementing the Quality Assurance/Control program. The following section of this report provides a summary of the physical make-up of the sampling network and the measurements that took place. It also provides a review of the field data acquisition operations and points out some of the problems encountered and their effect on the eventual data capture success.

3.1 Overview

The Annual Satellite Network consisted of a total of 55 field measurement sites, situated in the Central Valley, Sierra Foothills, the Bay/Delta complex and Tehachapi/Mojave Desert areas of California. **Figure 3-1a** shows a large-scale map showing the overall sampling area and **Figure 3-1b** provides smaller scale detail maps of the Bay/Delta area, and the greater Fresno and Bakersfield areas.

Precise site locations by latitudinal and longitudinal coordinates were established by the CRPAQS Field Manager using GPS field measurements after the completion of the field measurements phase of the project. The coordinates, as well as site elevations and physical descriptions, are listed in **Appendix A** of this report. This information was provided by the CRPAQS Field Manager (McDade, 2002).

A tabular summary of the Annual Satellite Network sites providing site code identifications, and parameters measured at each location is presented in **Table 3-1.** The table includes all the sites that operated as Annual Sites during the 14-month operational period of the Annual campaign. Some of these sites where also utilized for additional monitoring during the Fall 2000 Saturation Program and/or the Winter 2000-2001 Program. In addition, the five sites that operated only for the summer are included in Table 3-1, and are indicated as "summer" in the Measurements column.

Table 3-1. Site Names, Codes, Measurements—CRPAQS Annual Satellite Network

Site Name	Code	Measurements [1]
Angels Camp Stn.	ACP	b, c,
Altamont Pass Stn.	ALT1	b, N
Angiola	ANGI	b
Bakersfield Stn. (5558 California St.)	BAC	d
Barstow	BARS	N
Bakersfield Stn. (1128 Golden State)	BGS	g, h
Bodega Bay Stn.	BODB	b, c, N, hc
Bouquet Canyon Stn.	BQUC	N (summer)
Bakersfield Residential Area Stn.	BRES	b, c
Bethel Island Stn.	BTI	b, c, d, N
Cajon Pass Stn.	CAJP	N (summer)
Cantil Stn. [2]	CANT	N (summer)
Carrizo Plain Stn.	CARP	b, N
China Lake Stn.	CHLV	b, c, d, N
Clovis Stn.	CLO	b, c
Corcoran Stn. (Patterson)	COP	b, c, d, g, h
Crows Landing (Patterson) Stn.	CRLD	N
Dublin Stn.	DUB1	N
Edison_CRPAQS Stn.	EDI	b
Edwards AFB Stn.	EDW	b, c, d, N
Feedlot or Dairy Stn.	FEDL	b, c, d, N
Fellows Stn.	FEL	b, c, d, N
Foothills Stn. (above Fellows)	FELF	b, c, N
Fresno motor vehicle Stn. (IMS95-site F27)	FREM	b, c, N
Fresno Residential Area Stn. (near First St.)	FRES	b, c, d, N
Fresno Stn. (Drummond)	FSD	g, h
Fresno Stn. (3425 First St.)	FSF	d
Hanford Stn. (Irwin St.)	HAN	g, h,
Helm/Central Fresno County Stn.	HELM	b, c, d
Kettleman City Stn.	KCW	b
Trimmer Stn. (Kings River Valley)	KRV	N
Livermore Stn.-793 Rincon at Pine	LVR1	b, c, d
Modesto Stn. (814 14th St.)	M14	b, c, d, g, h
Mojave-Poole	MOP	b, c
Merced Stn. (M St.)	MRM	b, c
Oildale Stn. (3311 Manor)	OLD	b, c, g, h
Olancha Stn. (Walker Creek Rd.)	OLW	b, c, d, N, HC
Pacheco Pass Stn.	PAC1	b, N
Pixley Wildlife Refuge Stn.	PIXL	b, c, d, N
Pleasant Grove Stn.	PLEG	b, c
Sacramento Stn. (1309 T St.)	S13	b, c, d
Sacramento Stn. (Del Paso Manor)	SDP	d, N
Selma Airport Stn.	SELM	b, c, N
San Francisco Stn.(10 Arkansas St.)	SFA	b, c
San Jose Stn. (4th St.)[2]	SJ4	d, N (STI) [2]
Soledad Canyon Stn.	SLDC	N (summer)
Sierra Nevada Foothills Stn.	SNFH	b, c, d, N
Stockton Stn. (Hazelton St.)	SOH	b, c
SW Chowchilla Stn.	SWC	b, c
Tehachapi Pass Stn.	TEH2	b, N

Table 3-1. Site Names, Codes, Measurements—CRPAQS Annual Satellite Network

Site Name	Code	Measurements [1]
Tejon Pass Stn.	TEJ	N
Visalia Stn. (Church St.)	VCS	b, c, g, h
Walnut Grove Tower Stn.	WAG	N
Walker Pass Stn.	WLKP	N (summer)
Yosemite NP/Turtleback Dome Stn.	YOSE	d, HC

Abbrev. Notes:

Note 1 DRI Filter Designations		CRAPAQS Integrated Database Filter Designations		Designation Descriptions
FTC	(b type)	TCC	$PM_{2.5}$	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
FQN	(c type)	QNC	$PM_{2.5}$	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.
TTC	(g type)	TCC	PM_{10}	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
TQN	(h type)	QNC	PM_{10}	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.
GIF	(d type)	TIG	$PM_{2.5}$	Teflon impregnated glass fiber filters for organic speciation

Other Measurements		
HC	=	Hydrocarbon
N	=	Nephelometer

Note 2	SJ4 nephelometer was taken over by Sonoma Technology and will be reported by them.

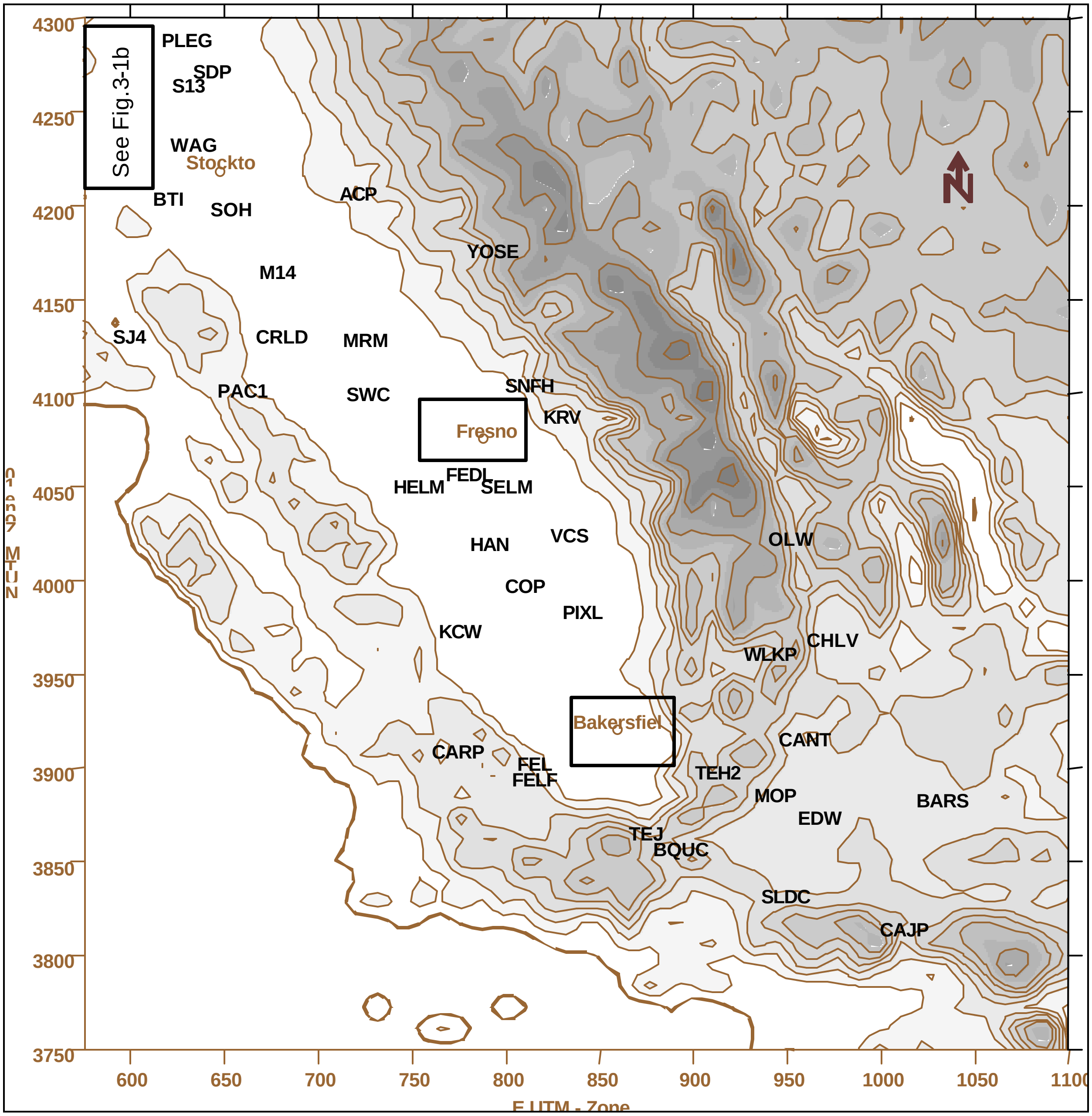


Figure 3-1a. Site Map Showing CRPAQS Annual Satellite Network (Fresno, Bakersfield, and Central/North Bay Areas shown in Figure 1-1b)

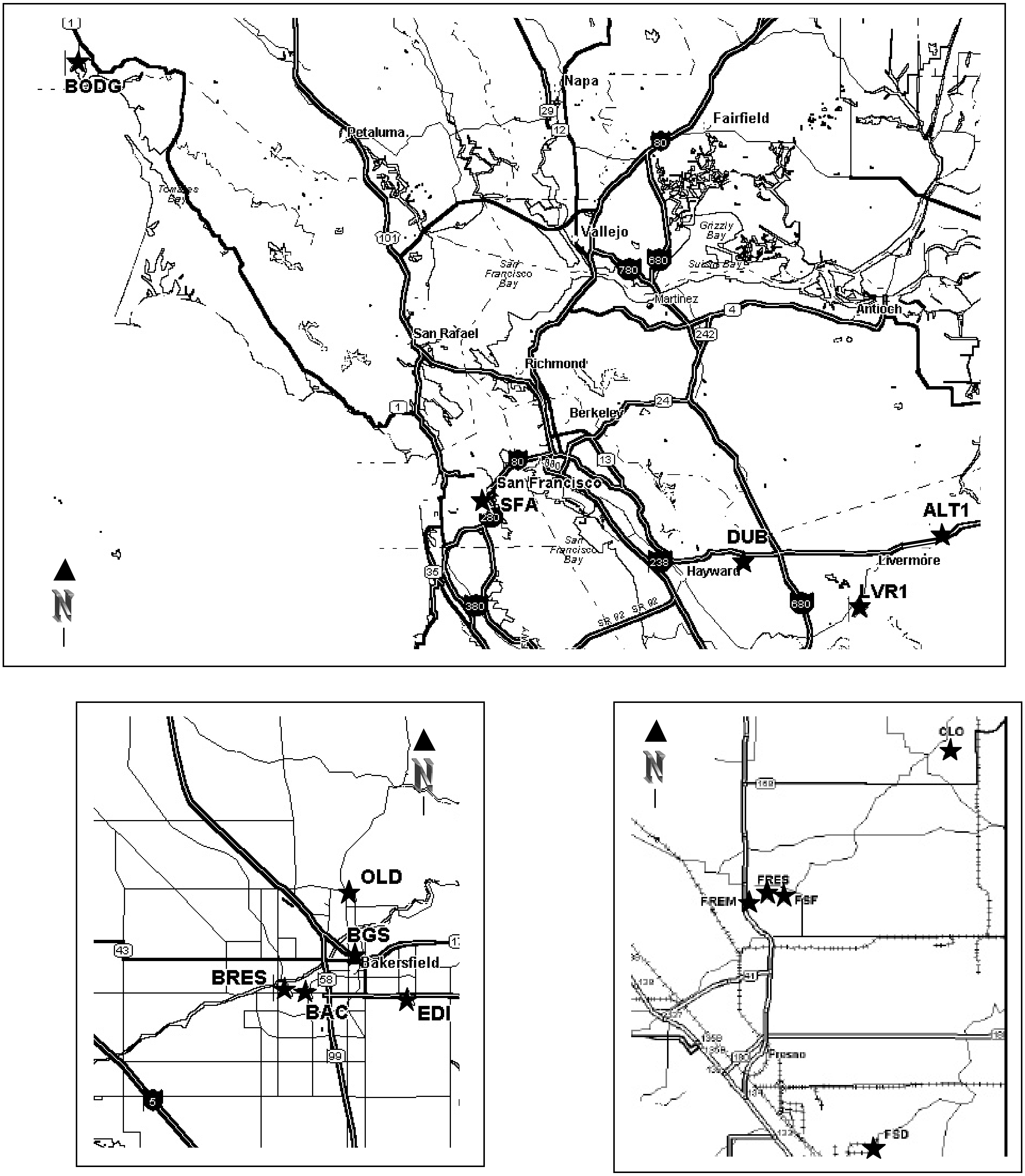


Figure 3-1b. Site Map Showing Bay Area (top), Bakersfield Area (lower left), and Fresno Area (lower right) – CRPAQS Annual Satellite Network (from DeLorme 2001)

3.2 Operations

The Satellite Network Annual campaign was operational over a 14-month period, and consisted of continuous measurement of the light-scattering coefficient (b_{sp}) at 30 sites, with filter measurements of $PM_{2.5}$ and PM_{10} airborne particulate matter made on 6-day intervals at 44 sites. Field personnel traveled to the sites for maintenance between each sampling period. The b_{sp} data was downloaded onsite to portable computers, and exposed filter packs were picked up and fresh filter packs installed at filter sampling sites. Over the 14-month monitoring period there were 72 sampling days with over 6,000 filter packs exposed, and approximately 2.5 million valid 5-minute b_{sp} data points.

Exposed filters and downloaded b_{sp} data were taken to established field depository sites at Bakersfield, Modesto, and Dixon. Field personnel logged in all of the collected data, stored and shipped the filters to the DRI lab, and did initial data processing of downloaded b_{sp} data at the three field office locations. The preliminary b_{sp} data was then transferred via electronic media to the T&B Systems Data Manager in Santa Rosa where the data files were merged into a master database and initial data validation procedures were performed.

3.2.1 MiniVol Filter Sampling

The MiniVol filter samplers were programmed to begin at midnight and to run continuously for 24-hours. The samplers were mounted so that their inlet was approximately 3 meters above the ground. The samplers were equipped to operate from either AC or DC power sources. In the DC mode, the sampler was attached to a charged battery pack prior to field sampling, making sampler operation independent of external power. Where AC power was available, the charged battery pack remained connected to the operating MiniVol as it maintained battery charge with power from an onsite AC adaptor. Each sampler operating at sites with no available AC power had two storage batteries. While a sampler was operating on one battery (up to 24 sampling hours on a single charge), a second battery pack was being recharged at one of the field depository locations.

A tabulated site-by-site summary of the MiniVol filter sampling is presented in **Appendix C.**

T&B Systems field technicians conducted site visits to recycle MiniVol samples during the 6-day periods between the 24-hour sampling runs. A total of 72 of these cycles took place during the 14 month Annual Program. During the site visits, exposed filter packs were removed from the MiniVol samplers and replaced by unexposed weighed filter packs which had been shipped to the field from DRI in Reno. The exchange of the filter packs in the field required removing the pack from the sampler impactor inlet assembly and installing a plastic cap on the filter holder. A similar plastic cap was removed from the unexposed filter pack, and the holder was installed on the sample inlet. **Appendix B** of this report shows the setup of the filter sample pack and the configuration of the filter pack and the MiniVol sampler impactor inlet assembly. In addition, Appendix B also contains the standard operating procedures that were followed by the field operators. The operators exercised great care to prevent inadvertent exposure of the sample filters to ambient particles during the short periods when the filter packs were disengaged from the sampling assembly. After the filter packs were installed, the MiniVol timing devices were reset to start sampling at 0001 hours of the next scheduled sampling day.

The field operators documented each MiniVol site visit operation on two forms, which appear in Appendix B of this report. One form was furnished by DRI, and was intended to provide the filter ID number and site location of the filter packs that were exchanged, and the sampler operating flow rate noted at the time of the site visit. The duration of the sampling period, as determined from the advancement of the MiniVol run time recording meter, was also documented on the DRI forms. The operators also filled out an additional T&B Systems MiniVol site visit form during each site visit. This form contained the information recorded on the DRI, plus additional site information not included on the DRI form, which served as documentation of the overall site operation.

The exposed filter packs retrieved during each site visit were sealed in plastic zip lock bags and transported back to the respective field offices as soon as possible after removal from the samplers in the field. The sample packs were transported in insulated ice chests containing frozen coolant packs. The filter packs were stored in refrigerators at around 0 to 8 degrees C at the field offices and then shipped to DRI in insulated containers containing frozen coolant. Most samples were transported via personal vehicle to DRI by T&B Systems personnel, and “fresh” unexposed filter packs were brought back to the field offices in the same fashion. Commercial shippers were utilized when logistical circumstances precluded the personal transportation.

3.2.2 Nephelometer Monitoring

Light scattering (b_{sp}) was measured at 30 sites during the 14-month Annual monitoring campaign. **Table 3-2** shows the site location of each nephelometer serial number, and the period of operation.

Table 3-2. Nephelometer Location/Operating Period – CRPAQS Annual Satellite Network

Site	Serial #	Start Ops	Stop Ops
ALT1	0233	1/19/00	2/8/01
BARS	0271	6/30/00	2/2/01
BODB	0194	12/23/99	5/10/00**rf**
BODB	0248	12/4/00	2/4/01
BQUC	0274	7/3/00**s**	9/8/00
BTI	0248	3/17/00	10/4/00 **rf**
BTI	0311	11/9/00	2/10/01
CAJP	0277	7/21/00**s**	9/8/00
CANT	0276	7/11/00**s**	9/12/00
CARP	0261	7/1/00	10/5/00 **rf**
CARP	0308	12/5/00	2/7/01
CHLV	0237	2/17/00	2/5/01
CRLD	0275	8/9/00	10/5/00 **rf**
CRLD	0290	11/29/00	2/7/01
DUB1	0229	1/20/00	10/4/00
DUB1	0261	11/22/00	2/20/01
EDW	0235	2/8/00	2/10/01
FEDL	0292	7/6/00	10/09/00?
FEDL	0294	12/3/00	2/5/01
FEL	0234	2/1/00	10/5/00**rf**
FEL	0290	12/5/00	2/7/01
FELF	0249	3/15/00	10/5/00 **rf**
FELF	0307	12/5/00	2/7/01

Site	Serial #	Start Ops	Stop Ops
FREM	0211	1/21/00	2/4/01
FRES	0230	1/29/00	2/4/01
KRV	0247	3/16/00	10/12/00**rf**
KRV	0312	11/30/00	2/8/01
OLW	0231	2/17/00	2/5/01
PAC1	0214	2/3/00	2/7/01
PIXL	0210	1/26/00	12/14/00
PIXL	0302	12/14/00	2/7/01
SDP	0212	12/24/99	01/11/00
SDP	0264	5/11/00	7/14/00
SDP	0293	8/7/00	11/14/00
SELM	0193	3/16/00	5/10/00
SELM	0263	5/11/00	2/5/01
SJ4	0228	2/3/00	7/21/00
SLD	0278	6/30/00**s**	9/8/00
SNFH	0227	1/22/00	2/8/01
TEH2	0232	2/10/00	2/5/01
TEJ	0236	2/15/00	2/8/01
WAG	0291	8/15/00	2/2/01
WLKP	0275	7/3/00**s**	9/11/00

rf = removed for fall and reinstalled later
s = operated during summer

The Radiance Research model M903 nephelometers were used for the b_{sp} measurements. Each was enclosed within a sealed wooden enclosure designed specifically for the instrument, which was aspirated by a second fan. Each enclosure and the sampler air inlet were situated 2 to 3 meters above the ground. When inlet air exceeded 70 percent relative humidity (RH), a heater attached to the instrument inlet was activated, thus keeping this upper RH limit from being exceeded.

Five-minute data averages were stored internally in the nephelometers in a non-volatile RAM, and retrieved using a portable computer on a scheduled basis. Typically the data were retrieved within 11 days of the previous visit; the data storage capacity of the instruments internal data logging system is 12 days. As a part of a Quality Assurance program, standard procedures and check sheets were followed during each site visit and data download (an example of the nephelometer routine servicing forms is given in **Appendix B.6**). The forms completed in full by the field technicians during each visit assured complete consistency and the instruments' being fully operational, and these forms also served as a detailed performance and maintenance record for each instrument, as well as documentation of all pertinent site log information. Each site visit also entailed a complete visual inspection of all instrumentation. A limited screening of the data downloaded was performed onsite to assure its quality and continuity and to ascertain that the unit itself was still operating according to specifications. When a problem was encountered, steps were taken instantly to get the instrument back in order. On the rare occasion when corrections were not possible, the instruments were replaced entirely. An additional procedure performed during each visit was to advance through successive display screens on the nephelometer, each screen detailing operational parameters that were significant toward the collection of valid data. This again assured in a quick visual check that the unit was performing adequately, and meticulous notes on each screen were maintained via a form designed specifically for this purpose and for later review and analysis (Appendix B.6).

The downloaded 5-minute averaged nephelometer data were immediately saved to disk, and also copied onto a diskette. Downloaded data were transferred to T&B Systems via the Internet once the technician was back at his home base. Each data file was assigned a unique name based on the site name and download date. Hard copies of all data were organized and stored by the field tech, assuring continuity and backups throughout the project.

Zero and span calibrations, using standard Freon 134a (SUVA) gas and a zero filter, were performed on each instrument throughout the project, at first (once each site was established) every visit until the field technician was satisfied with the units consistent performance, and then every 6 weeks thereafter. A final calibration was performed by T&B Systems technician's onsite after field monitoring was terminated.

3.2.3 Hydrocarbon Sampling

As an adjunct to the main objective of measuring PM parameters in the CRPAQS Program, sampling of volatile organic compounds also took place at three selected locations in the Satellite Network. This sampling sub-set of the main Annual Program was intended to provide some information as to the possible existence of background hydrocarbon (HC) compounds in the Project sampling domain. The measurement strategy was to take time-integrated ambient air samples at three boundary sites. Each sample was made using a pumping system connected to an evacuated Summa type metal canister that was "filled" with ambient air at a constant, controlled flow-rate for 24 hours. Satellite Network field technicians operated HC sampling on the same six-day schedule as the PM MiniVol filter sampling. Standard operating procedures for the HC sampling operations appear in Appendix B of this report. HC sampling took place at the Bodega Bay (BODB), Olancha (OLW) and Yosemite Turtleback Dome (YOSE) sites during the duration of the Annual Program. A summary of the hydrocarbon sampling operations is provided in **Table 3-3.**

Sampling occurred every 6-days beginning at midnight and ending the following midnight (PST). When an exposed canister was removed, the sample pressure was recorded on a standard form as well as data and site information. The sampler apparatus (pump, valves, and timer) were checked for proper operation before the next canister was installed. The starting pressure of a new canister was also recorded. Initially, exposed canisters were immediately shipped back to OGI for analyses until it was ascertained that the system and procedures were operating correctly.

Evacuated HC canisters were provided to each of the three sampling sites by the Oregon Graduate Institute (OGI) in Beaverton, Oregon. Satellite Network field technicians were responsible for completing and documenting the field operations procedures, and shipping the filled canisters back to OGI, where the samples were analyzed.

Table 3-3. Hydrocarbon Sampling Summary—CRPAQS Annual Satellite Network

	December 1999					January 2000						February 2000				March 2000					
Site/Date	2	8	14	20	26	1	7	13	18	25	31	6	12	18	24	1	7	13	19	25	31
BODB	installed 12/25/99				x	x	x	x	x	x	x	x	x	x	x	x	x	x	ef	x	x
OLW	installed 1/21/00									oe	oe	x	x	os	os	x	x	x	x	x	x
YOS	x	oe	x	x	x	x	x	x	x	ef	ef	ef	x	x	x	x	x	x	x	x	x

	April 2000					May 2000					June 2000					July 2000				
Site/Date	6	12	18	24	30	6	12	18	24	30	5	11	17	23	29	5	11	17	23	29
BODB	x	x	x	x	x	ef	x	x	x	x	x	x	x	x	x	x	x	x	x	x
OLW	x	x	x	x	x	x	os	ef	x	x	x	x	x	x	x	x	x	x	x	x
YOS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

	August 2000					September 2000					October 2000					November 2000				
Site/Date	4	10	16	22	28	3	9	15	21	27	3	9	15	21	27	2	8	14	20	26
BODB	x	x	x	ef	ef	ef	ef	x	x	x	e	e	e	e	e	e	x	x	x	x
OLW	x	x	x	ef	ef	ef	x	ef	u	u	x	ef	u	u	x	x	x	x	x	x
YOS	x	x	x	x	x	ef	ef	ef	x	x	ef	x	x	x	x	x	ef	x	x	x

	December 2000					January 2001					
Site/Date	2	8	14	20	26	1	7	13	19	25	31
BODB	x	x	x	x	x	x	x	x	x	x	x
OLW	x	x	x	x	x	x	x	x	x	x	x
YOS	x	x	x	x	x	x	x	x	x	x	x

<u>Sample Key</u>

x	=	valid sample
os	=	over sampled
oe	=	operator error
ef	=	equipment failure
u	=	no documentation

3.3 Data Capture

The overall data capture rates for the primary parameters measured during the 14-month Annual Program have been determined in order that users of the data can be aware of problems that may affect data utility. Data capture in this report is defined as the ratio of the number of <u>valid</u> data records successfully achieved to the maximum number of data records possible. The computed rate is expressed in percent. A measurement was not considered to be possible at a given site during periods when monitoring equipment was not installed at that location.

During the early stages of the Annual Program, a shortage of nephelometers resulted in a shortfall of anticipated b_{sp} data because instruments were not available in the field. In addition, later in the project, some nephelometers were removed from established

Annual sites so that a full compliment of instruments could be operated at the Fall Saturation Study and Winter Program monitoring sites. The capture rates presented in this report do not reflect data loss due to the removal of Annual monitoring equipment for such strategic/logistical reasons.

3.3.1 MiniVol Filter Sampling

Filter sampling using MiniVol filter samplers took place at a total of 44 sites during the Annual Program. **Table 3-4** presents a summary of the data capture results by site and filter type. Appendix C of this report provides a more detailed site-by-site summary of the filter sample recovery.

The average data capture rates for each filter type for the duration of the 14-month Annual Program were: b (FTC) = 94%; c (FQN) = 95%; d (GIF) = 95%; g (TTC) = 95%; and h (TQN) = 94%.

The filter samples recovery rate presented here represents the rate of successful sample installment, operation on schedule, and retrieval of the samples from the sampling sites. A successful filter sample recovery also was considered valid if all the standard field operations procedures were followed, including handling and shipping between the analysis lab and the field site. The above rates are not reflective of the final recovery of Level 1 validated data, which is determined by the DRI lab analysis results.

It can be noted from Table 3-4 that the capture rate for the filter sampling field operations were well above 90 percent at all but three sites: Bakersfield Residential Area (BRES); China Lake (CHLV); and Edwards AFB (EDW). The primary reason for the relatively low rates at those sites was unreliable accessibility of the sites for the southern sector field technician crew. The BRES site was located on the closed campus at a public school where the technicians were required to be escorted into the site by school supervisory personnel. The escorts were not consistently available when sampler operation visits were attempted. In some cases, this resulted in the failure of the field crew to service the samplers on time. The CHLV and EDW sites were located at highly sensitive military installations where security clearance and sometimes escort was required. The sampler operations field crew was occasionally denied access to these sites because of military activities. In some cases, filter samples could not be retrieved on time as a result.

Table 3-4. MiniVol Data Capture—CRPAQS Annual Satellite Network

Site	Type	Data Capture
ACP	b	99%
ACP	c	100%
ALT1	b	100%
ANGI	d	96%
BAC	d	86%
BGS	g	91%
BGS	h	93%
BODB	b	96%
BODB	c	96%
BRES	b	70%
BRES	c	73%
BTI	b	99%
BTI	c	96%
BIT	d	99%
CARP	b	88%
CHLV	b	86%
CHLV	c	86%
CHLV	d	73%
CLO	b	92%
CLO	c	97%
COP	b	96%
COP	c	97%
COP	d	97%
COP	g	93%
COP	h	95%
EDI	b	88%
EDW	b	73%
EDW	c	76%
EDW	d	82%
FEDL	b	100%
FEDL	c	99%
FEDL	d	100%
FEL	b	97%
FEL	c	96%
FEL	d	99%
FELF	b	100%
FELF	c	96%
FREM	b	92%
FREM	c	93%
FRES	c	99%
FRES	d	100%
FRES	d	93%
FRES	b	96%

Site	Type	Data Capture
FSD	g	97%
FSD	h	99%
FSF	d	99%
HAN	g	95%
HAN	h	91%
HELM	b	93%
HELM	c	96%
HELM	d	97%
KCW	b	93%
LVR1	b	100%
LVR1	c	99%
LVR1	d	100%
M14	b	97%
M14	c	95%
M14	d	100%
M14	g	100%
M14	h	97%
MOP	b	99%
MOP	c	100%
MRM	b	100%
MRM	c	99%
OLD	b	93%
OLD	c	95%
OLD	g	91%
OLD	h	92%
OLW	b	93%
OLW	c	89%
OLW	d	91%
PAC1	b	96%
PIXL	b	97%
PIXL	c	97%
PIXL	d	91%
PLEG	b	95%
PLEG	c	100%
S13	b	96%
S13	c	97%
S13	d	95%
SDP	d	100%
SELM	b	99%
SELM	c	97%
SFA	b	100%
SFA	c	100%
SJ4	d	100%

Site	Type	Data Capture
SNFH	**b**	**95%**
SNFH	d	97%
SNFH	c	99%
SNFH	d	97%
SOH	b	96%
SOH	c	99%
SWC	b	97%
SWC	c	100%
TEH2	b	88%
VCS	b	99%
VCS	c	97%
VCS	g	95%
VCS	h	93%
YOSE	d	100%

3.3.2 Nephelometer Monitoring

A summary of data capture results for nephelometer measurements during the Annual Program are presented in **Table 3-5**. The table shows the percent of data capture determined by the ratio of the number of valid 5-minute averaged observations that were accomplished to the maximum observations possible. The actual number of observations possible depended on the availability of equipment, and varies from site to site. The results shown in the table are based on data recovered to Level 1 validation. Please refer to Section 7.1 of this report for a description of the nephelometer data validation results. Also, a more detailed time-resolved data recovery summary is presented in **Appendix D** of this report.

The overall Level 1 nephelometer data capture rate averaged for all the Annual sites for the 14-month duration of the Annual Program was 92 percent. The two most common reasons for data capture rates less than 90 percent was untimely field downloading of data due to operational problems, and equipment malfunction, particularly the valid operations of the prototype nephelometer RH heaters. During the early stages of the Annual Program, there was a shortage of heaters, and some of the installed units did not operate properly. In the Level 1 data process, b_{sp} data with RH readings greater than 75 percent are considered suspect instead of valid. If the user of the data determines that these suspect data are still usable, the data capture rate will increase significantly for some sites.

Table 3-5. Nephelometer Data Capture—CRPAQS Annual Satellite Network

Site	Data Capture (%)
ALT1	97
BARS	89
BODB	85
BQUC (S)	81
BTI	98
CAJP (S)	96
CANT (S)	NA
CARP	82
CHLV	89
CRLD	99
DUB1	99
EDW	NA
FEDL	95
FEL	79
FELF	86
FREM	96

Site	Data Capture (%)
FRES	94
KRV	98
OLW	87
PAC	97
PIXL	87
SELM	97
SLDC (S)	85
SNFH	96
TEH2	88
TEJ	77
WAG	96
WLKP(S)	97

S = Summer Only
NA = Not Available

3.3.3 Hydrocarbon Sampling

Although it was not in the scope of this contract to determine the validity of the samples taken, **Table 3-6** provides information on number of samples retrieved from each site. (See Table 3-3 for a detailed report on the recovery success on a site-by-site basis.)

Table 3-6. Hydrocarbon Samples Collection Rate – CRPAQS Annual Satellite Network

Site	Number of Samples Possible	Number of Invalid Samples	Number of Valid Samples	Valid Sample Percentages
BODB	68	12	56	82
OLW	63	15	48	76
YOSE	72	9	63	88

As indicated previously, there were many instances where data was lost due to instrument failure. In the summer of 2000, the sampling apparatus was redesigned by OGI and did not operate properly when initially installed. As there were no replacement units readily available, these units were adjusted in the field in hopes of obtaining a valid sample until replacement units arrived. Also, in some cases, samples indicating over-sample and equipment failure may still contain enough ambient air to provide a valid sample for analysis by OGI. In addition, at Bodega Bay, sampling was adversely affected by saltwater accumulation in the sampling inlet tube, and electrical interference after relocation to the greenhouse.

4. FALL PROGRAM

The objective of the field measurement phase of the Fall 2000 Saturation Program was to measure concentrations of particulate matter (PM) in conjunction with light-scattering coefficients (b_{sp}) in a subject area where significant PM loading normally occurs. Seasonal agricultural activities in and nearby the town of Corcoran provided the setting for the desired sampling conditions. An Interim Report detailing the Fall Study was prepared under separate cover and submitted to the San Joaquin Valleywide Study Agency (SJPA) and the California Air Resources Board (CARB) (T&B Systems, July 2001)

4.1. Overview

Field data acquisition monitoring for the Fall 2000 Saturation Program was conducted from October 8, 2000 to November 14, 2000. The sampling network consisted of 26 sampling site locations, 23 in the vicinity of Corcoran, and 3 near Hanford, California. **Figure 4-1a** provides a map of the Corcoran area showing site locations and **Figure 4-1b** shows a larger scale map of the area that includes the Hanford vicinity sites.

Precise site locations by latitudinal and longitudinal coordinates were established by the CRPAQS Field Manager using GPS field measurements after the completion of the field measurements phase of the project. The coordinates, as well as site elevations and physical descriptions, are listed in Appendix A of this report. This information was provided by the CRPAQS Program Field Manager.

A listing of the Fall Sites, ID Codes, and parameters measured at each location is presented in **Table 4-1**. The table lists the sites where nephelometers (b_{sp} measurements), and/or MiniVol filter samplers (PM_{10} sampling) were operated daily for the Fall Program. The Corcoran Patterson site (COP), and the Hanford site (HAN) also operated as Annual Program sites, independently of the Fall Program (McDade, 2002).

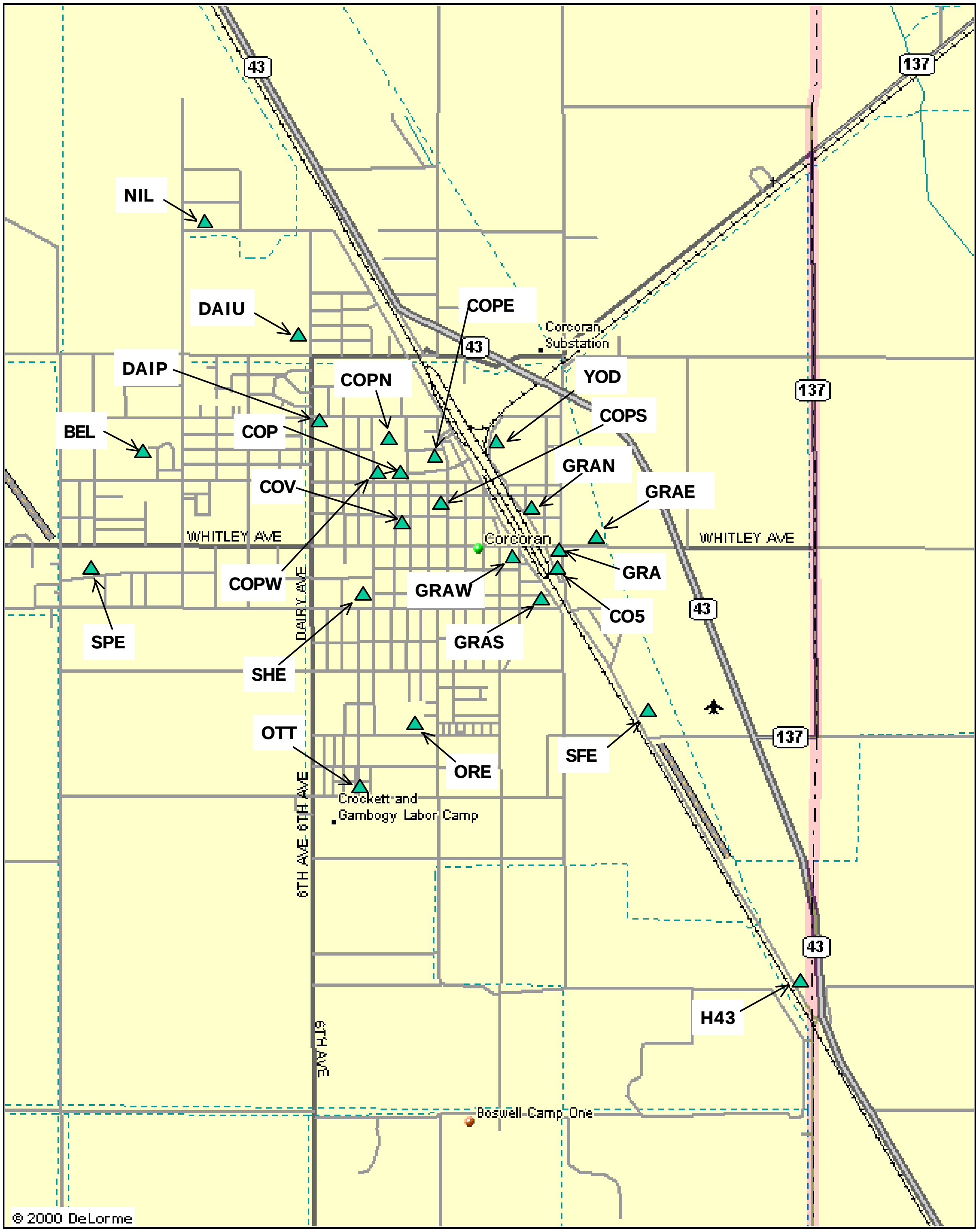


Figure 4-1a. Site Map Showing Corcoran Area – CRPAQS Fall Saturation Network

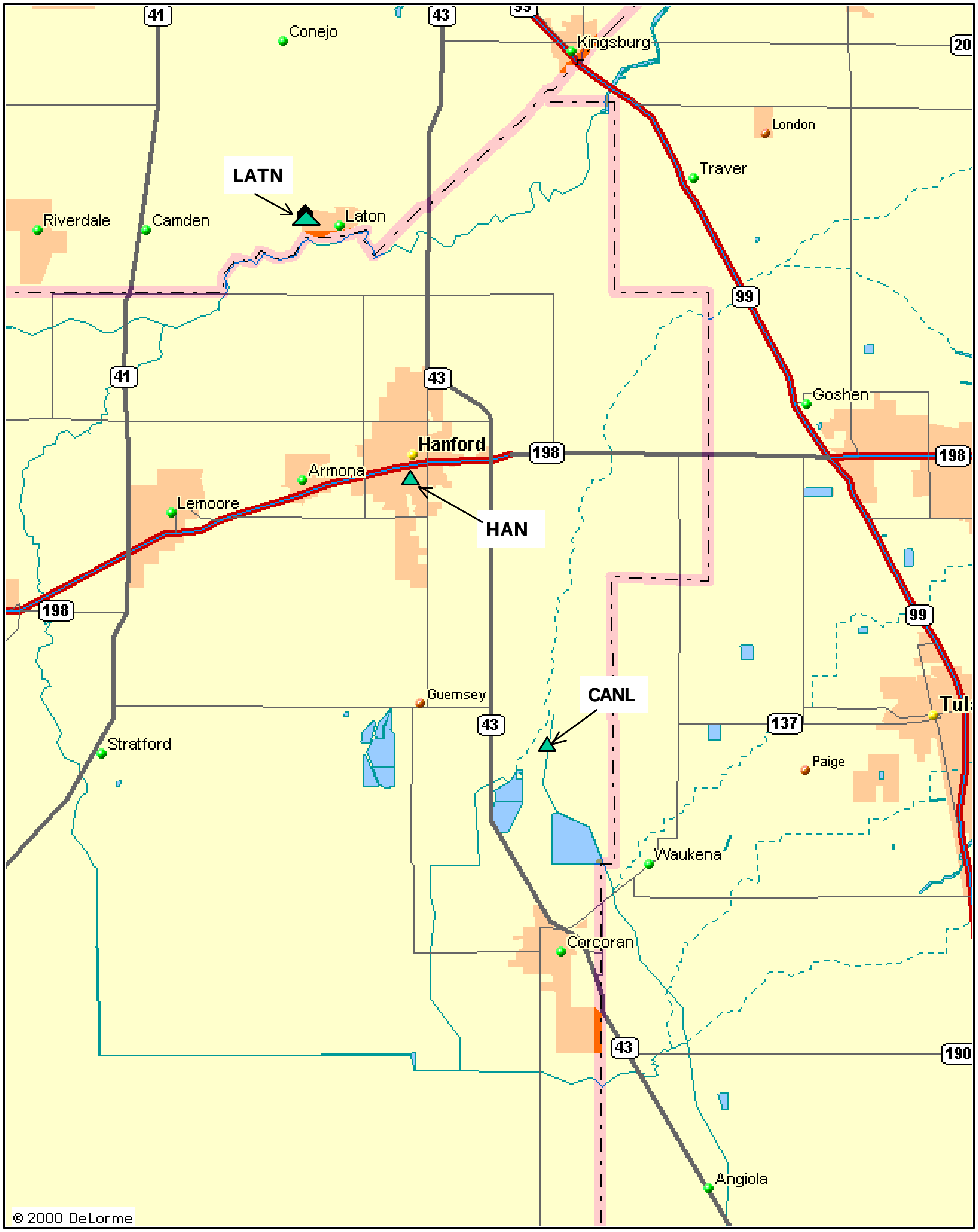


Figure 4-1b. Site Map Showing Hanford, Laton, and Canal Sites—CRPAQS Fall Saturation Network

Table 4-1. Site Names, Codes, Measurements—CRPAQS Fall Saturation Network

Site Name	Code	Measurements[1]
Corcoran - Bell St. (BEL)	BELL	N
Corcoran Stn. (Pickrell)	C05	g, N
Canal Stn	CANL	N
Corcoran Stn. (Patterson)	COP	g, h i
Corcoran Focus East Stn	COPE	N
Corcoran Focus North Stn	COPN	N
Corcoran Focus South Stn	COPS	N
Corcoran Focus West Stn	COPW	N
Corcoran Stn. (1000 Van Dorsten)	COV1	N
Dairy Road paved Stn.	DAIP	g, N
Dairy Road-unpaved Stn.	DAIU	g, N
Grain elevators Stn	GRA	g, h, i, N
Grain elevators east Stn.	GRAE	N
Grain elevators south Stn	GRAS	g, h, i, N
Grain elevators west Stn	GRAW	N
Grain elevators north Stn (GRAN)	GREN	N
Highway 43 Stn.	H43	g, h, i, N
Hanford Stn. (Irwin St.)	HAN	g, h, i, N
Laten Stn	LATN	N
Corcoran - Niles St Stn.	NIL	N
Corcoran - Oregon St. Stn.	ORE	g
Ottawa Stn.	OTT	N
Santa Fe Stn.	SFE	g, h, i, N
Corcoran - Sherman St. Stn. (SHE)	SHER	N
Corcoran - Spear St. Stn.	SPE	N
Yoder St. Stn.	YOD	g, N

Abbrev. Notes:

Note 1 DRI Filter Designations		CRAPAQS/CCOS Integrated Database Filter Designations		Designation Descriptions
TTC	(g type)	TCC	PM_{10}	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
TQN	(h type)	QNC	PM_{10}	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.
TPN	(i type)	TIG	PM_{10}	Teflon impregnated Nuclepore glass filters for organic speciation.

Other Measurements		
N	=	Nephelometer

4.2 Operations

T&B Systems operated nephelometers continuously at 24 sites and MiniVol samplers at 11 sites. The site at the Oregon Street (ORE) did not have a nephelometer) An additional nephelometer was operated by Sonoma Technology, Inc. (STI) at the COP core site, and is part of their database for the Annual Project.

Two field technicians stationed at the T&B Systems CRPAQS field office in Visalia, California carried out T&B Systems field operations for the Fall Program. In addition, the T&B Systems CRPAQS Field Manager assisted the Visalia crew in the field, and conducted the data and samples dissemination and shipping activities. Field storage of filter samples and supplies, battery charging, equipment testing and calibrations, and general maintenance were conducted at the CRPAQS Angiola field facilities 10 miles south of Corcoran. Shipping and receiving of filter samples was done through commercial facilities in Corcoran and Visalia.

T&B Systems field technicians initially bench tested and calibrated the MiniVol samplers and nephelometers used in the Fall project at the CRPAQS field laboratory facility at Angiola several days prior to installation in the field. The T&B Systems crew was also responsible for installing the equipment at the sites, which had been selected and established by the CRPAQS Field Manager in early October.

Fall 2000 Saturation Network sampling and monitoring operations commenced on October 8, 2000 and was completed on November 14, 2000. The T&B Systems crew made daily site visits to all 11 MiniVol sites and up to 8 nephelometers sites during the sampling period. This insured that the b_{sp} data were downloaded and checked at no greater than 4-day intervals. Fresh and exposed filters were transported by the field crew to and from the Angiola facility in cold pack containers, and were stored there in refrigerators. Shipping of filters to and from the DRI laboratory in Reno took place after every third day, except when required more frequently due to filter pack availability. Nephelometer data were downloaded using portable field computers. Downloaded data files were backed-up onto diskette immediately after downloading, and archived at the Visalia office. Initial Level 0 quality control checks were performed on the data before being transferred to T&B Systems in Santa Rosa over the Internet.

The data management staff at T&B Systems conducted nephelometer data processing and validation. Filter samples were shipped to the DRI lab facility where laboratory analyses were carried out.

4.2.1 MiniVol Filter Sampling

Prior to the start of the field sampling period, MiniVols used in the Fall 2000 program were calibrated indoors at the Angiola facility by T&B Systems technicians. Each MiniVol sampler was set for a nominal flow rate of 5.0 pm using a flow meter calibrated against a certified standard. The procedure was done using filter packs configured exactly like the three types used in the field. Flow rates were adjusted for ambient temperature and pressure representative of the expected levels during the Fall Program. A second round of MiniVol calibrations was conducted by CRPAQS auditing personnel on October 23 and 24. Those calibrations took place insitu using the operational filters in place at that time. MiniVol calibration results for the project are further discussed in Section 6.3 of this report.

During the Fall 2000 Program, the MiniVol samplers were programmed to begin at midnight and run continuously for 24-hours. The samplers were mounted so that their inlet was approximately 3 meters above the ground. The samplers were equipped to operate from both AC and DC power sources. In the DC power mode, the sampler was attached to an external high-capacity battery, making sampler operation independent of external power. Where AC power was available, the battery charger remained connected to the operating MiniVol. Each sampler operating at sites with no available AC power had two storage batteries. While a sampler was operating on one battery (up to 24 sampling hours on a single charge), the other battery was being charged at the Angiola field lab facility. Every MiniVol sampling site had two samplers of each filter type so that while one unit was sampling, the other unit was being serviced (filter changed and charged battery installed). In this manner, sampling could be carried out without interruption.

A tabulated site-by-site summary of the MiniVol filter sampling is presented in Appendix C.

4.2.2 Nephelometer Monitoring

Light-scattering (b_{sp}) was measured at 25 sites in the Fall Program. T&B Systems was responsible for overseeing 24 of the sites. **Table 4-2** shows the site location of each nephelometer, the unit serial number, and the period of operation.

The Radiance Research model M903 nephelometers were utilized for the b_{sp} measurements in the same general configuration as in the Annual CRPAQS Satellite Network Program. Sampler air inlet was located approximately 3 meters above the ground. When sample air exceeded 70 percent relative humidity, a heater attached to the instrument inlet was activated. Many nephelometer systems operated at monitoring sites where AC power was not available. At those locations, DC power from onsite 12-volt storage batteries was used. The DC power was converted to AC required to run the nephelometer and nephelometer exhaust fan. The enclosure fan and air inlet heater ran directly on 12 volts DC. The DC heater and controller were specially built for this project. The onsite 12-volt batteries were housed in secure metal boxes mounted at ground level below the nephelometer enclosure assemblies. Batteries were routinely charged and replaced.

Five-minute data averages were stored internally in the nephelometers in a non-volatile RAM, and retrieved using a portable computer on a scheduled basis. Typically, the data were downloaded once every 3 days, however, other operational requirements sometimes prevented that schedule. The data storage capacity of the instruments' internal data logging system is 12 days.

Zero and span calibrations, using standard Freon 134a (SUVA) gas and a zero filter were performed three times on each instrument during the Fall Program. Results of the calibrations are discussed further in Section 6.3 of this report. T&B Systems technicians performed the initial pre-operations calibrations indoors at the Angiola facility prior to October 7, 2000. This also served as a bench test for the instruments before they were installed at the field sites. A second calibration series was performed onsite by the CRPAQS auditors on October 23 and 24, 2000. A final calibration was performed by T&B Systems technicians after field monitoring terminated on

Table 4-2. Nephelometer Location and Operating Period—CRPAQS Fall Saturation Network

Site	Serial #	Start Ops	Stop Ops
BEL	0276	10/9/00	11/1/00
	0248	11/1/00	11/14/00
CANL	0234	10/25/00	11/14/00
CO5	0292	10/10/00	11/14/00
COPE	0290	10/9/00	11/14/00
COPN	0305	10/12/00	11/14/00
COPS	0303	10/12/00	11/14/00
COPW	0272	10/9/00	11/14/00
COV	0304	10/9/00	11/14/00
DAIP	0264	10/11/00	11/14/00
DAIU	0249	10/10/00	10/20/00
DAIU	0308	10/20/00	11/14/00
GRA	0275	10/11/00	11/14/00
GRAE	0277	10/9/00	11/14/00

Site	Serial #	Start Ops	Stop Ops
GRAS	0301	10/10/00	11/14/00
GRAW	0300	10/9/00	11/14/00
GREN	0270	10/9/00	11/14/00
H43	0302	10/13/00	11/14/00
HAN	0229	10/9/00	11/14/00
LATN	0306	10/25/00	11/15/00
NIL	0278	10/9/00	11/14/00
OTT	0247	10/13/00	11/14/00
SFE	0261	10/9/00	11/14/00
SHER	0273	10/10/00	11/15/00
SPE	0307	10/18/00	11/14/00
YOD	0248	10/9/00	11/1/00
YOD	0276	11/1/00	11/14/00

November 14, 2000. Every effort was made to perform the final calibrations while the instruments were still installed at the sampling sites, however, operational requirements necessitated removing about half of the instruments before calibrations could be made. The nephelometers that had been removed from the field were calibrated indoors at a facility in Hanford.

The T&B Systems field crew visited each nephelometer site every three days when possible. Due to operational constraints, up to eight days went by between some site visits. The battery capacity at the DC sites was adequate to provide around six to seven days operation. The field technicians changed batteries and downloaded data during each site visit. The batteries were recharged at the Angiola facility.

4.3 Data Capture

Unseasonably wet weather conditions, shortage of instruments, and untested prototype equipment were the main problems affecting the volume and quality of data capture during the Fall Program. Unusual rainfall in early October slowed down site installation activities. Additional rain events later in the study hampered monitoring operations and inhibited fugitive soil emissions. Weather also had a significant effect on the agricultural harvesting activities in the area that were the focus of the study. Although enough MiniVols were available for the Project, a delayed shipping schedule from the manufacturer created a short supply of nephelometers which necessited “borrowing” instruments from lower priority CRPAQS Annual Satellite Network sites. Some damage to those instruments was incurred during the moving process. The DC power system and inlet heaters had not been bench tested before field installation. A number of heater controllers were internally wired incorrectly and some RH sensors did not interface properly with the heater controllers. In addition, one site was vandalized twice, the Hanford District site was exposed to nearby heavy construction, and already ambitious technician work schedules were interrupted by the extra maintenance requirements. Nevertheless, a considerable volume of data was collected, and overall data capture exceeded 90 percent. The following is a summary of the data retrieval results.

4.3.1 MiniVol Filter Sampling

Filter sampling took place daily at 11 sites in the Fall Study. There were 23 samples per day. A total of 851 samples were scheduled during the 37-day period of operation. Out of 851 possible samples, 71 were deemed invalid for a number of reasons, yielding 780 valid samples produced, which is a 92 percent overall data capture rate for the study. On any given day, data capture could range from 100 percent to a low of 38 percent (on October 30). **Table 4-3** presents a summary of the data capture results by site and filter type. The overall data capture rates for the duration of the Fall Study by filter type were 92 percent for "g" filters, 82 percent for "h" filters and 77 percent for "i" filters. Appendix C of this report provides a more detailed site-by-site summary of the filter sampling recovery.

Of the 71 invalid samples, 38 were either under or over sampled and may yet provide useable data in some cases. A heavy rainstorm accounted for loss of 15 samples on October 30. The majority of remaining failures was due to sampler and battery malfunction. An inordinate number of sampler malfunctions occurred during 6 days when very heavy fog was noted. In addition, 6 units were found with massive infestations of insects inside the sampler, possibly causing it to malfunction. Initially, there were several batteries that did not hold enough charge to complete a 24-hr sampling period. This resulted in 15 under-samples and 4 totally missed samples. Operator error was the cause of 5 lost samples. Two samplers were stolen from one location causing a loss of 4 samples, and one filter pack broke during sampling.

Table 4-3. MiniVol Data Capture—CRPAQS Fall Saturation Network

Site	Filter Type	Data Capture (%)
CO5	g	92
COP	g	97
COP	h	97
COP	i	86
DAIP	g	95
DAIU	g	97
GRA	g	97
GRA	h	100
GRA	i	97
GRAS	g	76
GRAS	h	97
GRAS	i	78

Site	Filter Type	Data Capture (%)
H43	g	86
H43	h	95
H43	i	92
HAN	g	92
HAN	h	97
HAN	i	86
ORE	g	97
SFE	g	92
SFE	h	86
SFE	i	97
YOD	g	100

4.3.2 Nephelometer Operations

A summary of the data capture for nephelometer measurements during the Fall Program are presented in **Table 4-4**. The table shows the data capture as the ratio of the number of valid 5-minute averaged observations obtained to the maximum number of observations possible. The overall data capture rate for all the Fall Program nephelometers was 94 percent. It should be noted that there were 24 sites in the original design scheduled to have nephelometer sampling. The Oregon St. site (ORE) was a filter sampling site only. Nephelometers were not available at the SPE site until October 18th, and at CANL and LATN sites until October 25th. The results shown in the table are based on data recovered to Level 1 validation. A more detailed site by site data recovery summary is presented in Appendix D of this report.

The most common cause for compromised data was due to heater controller failures causing inlet relative humidity to exceed 75 percent, the project-specified upper limit. This problem was particularly persistent at the LATN, NIL and SPE sites. These data were flagged as suspect data during validation. Another common cause of data loss was power failure. Those data losses are flagged as missing in the data archive.

Table 4-4. Nephelometer Data Capture—CRPAQS Fall Saturation Network

Site	Data Capture (%)
BEL	94
CANL	98
CO5	98
COPE	92
COPN	100
COPS	93
COPW	100
COV1	98
DAIP	100
DAIU	95
GRA	95
GRAE	100
GRAN	100

Site	Data Capture (%)
GRAS	91
GRAW	100
H43	89
HAN	100
LATN	72
NIL	85
OTT	98
SFE	92
SHE	95
SPE	81
YOD	93

5. WINTER 2000-2001 PROGRAM

The objective of the Winter 2000-2001 element of the CRPAQS Satellite Network Program was to increase the spatial and temporal density of PM and b_{sp} measurements within the context of the Annual Satellite Program. This was accomplished by adding MiniVol filter samplers and nephelometer b_{sp} monitors to a number of existing Annual Network sites, and by operating the filter samplers on a daily schedule, instead of an every sixth day schedule, during specific time periods designated by the CRPAQS project management team. These Intensive Operational Periods (IOP's) were initiated on a forecast basis, and required additional field crew manning in order to carry out the ambitious daily sequential filter sampling operations. In addition to the increased filter and b_{sp} field measurements, daily hydrocarbon sampling took place during IOP's at one site, and upper-air meteorological balloon soundings (Rawinsondes) were carried out at the Fresno and Bakersfield Anchor sites. The Winter Program took place from December 1, 2000 to February 3, 2001. A total of 15 IOP days occurred during that period.

5.1 Overview

On 15 select IOP days when high particulate loading was forecast, T&B Systems conducted intensified field measurement operations additional at the 30-site winter subset of the Annual Satellite Network. These supplemental sites are listed in **Table 5-1**. Daily IOP filter sampling took place at 25 of the sites and additional nephelometers were operated at 16 locations. The nephelometers ran continuously during the 2-month Winter Program. In addition, four hydrocarbon samples were collected daily at the Bodega (BODB) site. Upper-air meteorological Rawinsonde soundings were made at 6-hour intervals during the 15 IOP days at Fresno (FSF) and Bakersfield (BAC). Additionally, the National Weather Service at Oakland was contracted to make supplemental soundings on a corresponding schedule.

Precise site locations by latitudinal and longitudinal coordinates were established by the CRPAQS Field Manager using GPS field measurements after the completion of the field measurement phase. The coordinates, as well as site elevations and physical descriptions, are listed in Appendix A of this report. This information was provided by the CRPAQS Field Manager (McDade, 2002). Site location maps provided in Figures 3-1a and 3-1b of this report depict the geographical locations of the monitoring sites used in the Winter Program.

Table 5-1. Site Names, Codes, Additional Measurements for CRPAQS Winter Network

Site Name	**Code**	**Measurements**[1]
Angels Camp Stn.	ACP	b, c, N
Altamont Pass Stn.	ALT1	b
Bakersfield Stn (5558 California St.)	BAC	RW
Bodega Bay Stn.	BODB	b, c, HC
Bakersfield Residential Area Stn.	BRES	b, c, N
Clovis Stn.	CLO	b, c, N
Corcoran Stn. (Patterson)	COP	b, N
Edison_CRPAQS Stn.	EDI	N
Feedlot or Dairy Stn.	FEDL	b, c
Fellows Stn.	FEL	b, c
Foothills Stn. (above Fellows)	FELF	b, c
Fresno motor vehicle Stn. (IMS95-site F27)	FREM	b, c
Fresno Residential Area Stn. (near First St.)	FRES	b, c,
Fresno Stn (3425 First St.)	FSF	RW
Helm/Central Fresno County Stn.	HELM	b, c, N
Kettleman City Stn.	KCW	b, N
Livermore Stn.-793 Rincon at Pine	LVR1	b, c, N
Modesto Stn. (814 14th St.)	M14	b, c, N
Merced Stn. (M St.)	MRM	b, c, N
Oildale Stn. (3311 Manor)	OLD	N
Olancha Stn. (Walker Creek Rd.)	OLW	b, c, HC
Pixley Wildlife Refuge Stn.	PIXL	b, c
Pleasant Grove Stn.	PLEG	N
Sacramento Stn. (1309 T St.)	S13	b, c
Selma Airport Stn.	SELM	b, c
San Francisco Stn.(10 Arkansas St.)	SFA	b, c, N
Stockton Stn. (Hazelton St.)	SOH	b, c, N
SW Chowchilla Stn.	SWC	b, c, N
Tehachapi Pass Stn.	TEH2	b
Visalia Stn. (Church St.)	VCS	b, c, N

Abbrev. Notes:

Note 1 DRI Filter Designations		CRAPAQS/CCOS Integrated Database Filter Designations		Designation Descriptions
FTC	(b type)	TCC	$PM_{2.5}$	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
FQN	(c type)	QNC	$PM_{2.5}$	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.

Other Measurements		
HC	=	Hydrocarbon
N	=	Nephelometer
RW	=	Rawinsonde

5.2 Operations

Installation of the additional monitoring equipment required at the Winter sites took place during the last two weeks of November 2000. The additional MiniVol filter samplers and nephelometers needed had been used in the Fall Saturation Program, and were not available until after they were released and shipped from that project.

During late November 2000, T&B Systems field technicians also established and installed Rawinsonde sites in Fresno and Bakersfield. Additional hydrocarbon sampling equipment was installed at the Bodega Bay Annual site to accommodate more time-resolved measurements.

The 2-month long Winter Program began on December 1, 2000, and included 15 intensive operational days, which took place during four separate high PM episodes. The IOP periods were December 15 through 18, December 26 through 28, January 4 through 7, and January 31 through February 3. Extra field technical personnel were deployed during the IOP episodes in order to accomplish the daily recycling of filter and HC samples, and to run Rawinsonde balloon soundings around the clock. Nephelometers required no additional downloading beyond the usual 12-day cycle. Maintenance of the Annual Program monitoring operations was conducted concurrently with the IOP activities.

5.2.1 MiniVol Filter Sampling

Intensified $PM_{2.5}$ particulate sampling during Winter IOP episodes was accomplished by adding MiniVol samplers to 25 selected Annual sites within the CRPAQS Satellite Network. By adding a second sampler of each filter type to the IOP sites, filter sampling on consecutive IOP days was possible. On a daily basis, field technicians changed the filters on samplers that had run during the previous 24-hour period. The second sampler was running during the current 24-hour period. The extra IOP filters were all b (TCC) and c (QNC) type filters. Most IOP episodes included days that were also scheduled Annual sampling days. Samples from those days were handled in the usual manner. Field procedures, handling and documentation of the special Winter IOP filter sampling operations were accomplished using the same standard operating procedures as in the Annual Program (see Section 3.2.1). These SOP's appear in **Appendix B** of this report.

The extra MiniVols used in the Winter Program were included in an ARS internal audit of the entire Annual Satellite network that took place from November 28 through December 8. The sampler flow set-points were reset to reflect winter ambient conditions at that time.

5.2.2 Nephelometers

Sixteen new nephelometer sites were installed and operated continuously over the 2-month Winter Program period. The same equipment was employed and standard procedures followed as in the Annual Satellite monitoring (see Section 3.2.2). The standard operating procedures for nephelometer operations are presented in Appendix B of this report. Each monitor was zero/spanned in situ at installation and at removal. Data were downloaded at least every 12-days, and the data (and documentation) transmitted to T&B Systems in Santa Rosa. Sites added for the Winter Program are listed in **Table 5-2.**

The Winter nephelometers were included in the ARS internal audit of the Annual Satellite Network that took place from November 28 through December 8. Additional zero/span calibrations were run on the Winter nephelometers by T&B Systems field technicians prior to the takedown of the equipment in February 2001.

Table 5-2. Nephelometer Location and Operating Period – CRPAQS Winter Network

Site	Serial #	Start Ops	Stop Ops[1]
ACP	305	11/30/00	2/6/01
BRES	300	11/28/00	2/6/01
CLO	249	12/6/00	2/4/01 (2/16)
COP	274	12/1/00	2/6/01 (2/10)
EDI	234	11/28/00	2/6/01
HELM	264	11/29/00	2/5/01 (2/13)
KCW	229	11/27/00	2/8/01
LVR1	317	11/19/00	2/11/01 (2/20)
M14	301	12/1/00	2/5/01
MRM	212	12/1/00	2/5/01 (2/14)
OLD	247	11/28/00	2/6/01
PLEG	318	11/29/00	2/5/01
SFA	320	11/19/00	2/11/01 (2/18)
SOH	303	11/29/00	2/8/01
SWC	304	11/29/00	2/5/01 (2/12)
VCS	270	11/30/00	2/6/01

[1] Dates in ( ) indicate data available past end of Winter Program.

5.2.3 Hydrocarbon Sampling

A second HC sampling system was collocated with the Annual equipment at the Bodega Bay (BODB) site prior to the start of the Winter Campaign. The sampling system was set-up to fill the same type of evacuated metal summa canisters that were used for HC sampling in the Annual Program. Appendix B of this report contains the standard operating procedures and documentation forms used by the T&B Systems site operators.

In addition to the standard Annual sampling schedule, four 6-hour samples were collected daily during the Winter IOP episodes. A separate summa canister was filled for each of the following time segments: 0000 PST to 0500 PST; 0500 PST to 1000 PST; 1000 PST to 1600 PST; and 1600 PST to 2400 PST (midnight).

5.2.4 Rawinsondes

T&B Systems setup and operated two Rawinsonde stations; at Fresno and Bakersfield. Rawinsonde stations at the Oakland National Weather Service (NWS) and Vandenberg Air Force Base (Vandenberg) were contracted to provide additional soundings to CRPAQS on a schedule and data resolution to meet project specifications. As it turned out, Vandenberg personnel failed to meet those requirements and the data are not reported herein.

Rawinsonde measurements were made on a scheduled basis on IOP days only. When a "GO" was issued by the Project Forecaster, the NWS and Vandenberg personnel were alerted, and requested to take the first sounding at 0400 PST on the following day. T&B Systems personnel were dispatched to the sites at Fresno and Bakersfield. Soundings at those sites began at 0400 PST as well.

Soundings were scheduled at 6-hour intervals (0400, 1000, 1600, and 2200 PST) for the duration of the IOP. A sounding was required to reach at least 850 mb (~5,000 ft) without significant data loss or a repeat sounding was made. Data collection was terminated once the sounding reached an altitude of 500 mb (~18,000 ft). **Table 5-5** of this report presents a complete summary of the Rawinsonde data recovery results.

Surface measurements of temperature, humidity and winds at sounding release time were obtained from existing meteorological equipment at the sites. Surface pressure, which was used to calibrate the sonde pressure sensor, was obtained using precision barometers. If initial sonde measurements were inconsistent with "ground truth" measurements, the sonde was rejected.

T&B Systems post-processing and data validation consisted of computing height and dew point temperature, merging winds and temperature/humidity data into a common data file, and plotting. An experienced meteorologist checked the data plots for internal consistency. Data known to be out of range were flagged as invalid. Data that appeared inconsistent based on the reviewers experience but without compelling evidence of equipment malfunction were flagged as "suspect" and left in the database. The most common causes of record invalidation were a "wet bulb" effect on the temperature sensor and unrealistic wind shears in the first 30 seconds (2 records) of winds. When the sonde exits a cloud layer, liquid water that may have attached to temperature sensor evaporates creating an artificially steep lapse rate. Often, the initial winds from balloon soundings are suspect due to computational and/or tracking errors. Typical processing software artificially smooths the winds. The processing algorithm used in this project performs no smoothing, which requires an experienced meteorologist to review the winds for reasonableness.

5.3 Data Capture

The following section presents the data capture rates for the extra sampling done during the Winter Program IOPs and continuous monitoring at the additional sites supplementing the Annual Network. Data capture in this report is defined as the ratio of the number of valid data records successfully achieved to the maximum number of data records possible. The computed rate is expressed in percent. Data measurement was not considered to be possible at a given site during periods when monitoring equipment was not installed at that location.

Data capture rates for $PM_{2.5}$, b_{sp} and Rawinsonde data recovery during the Winter Program were generally very high, exceeding 90 percent in most cases. The special HC sampling at the BODB was 100 percent successful.

5.3.1 MiniVol Filter Sampling

Table 5-3 presents a summary of the data capture results for the additional Winter operations and the ongoing Annual sampling. Appendix C of this report provides a more detailed site-by-site summary of the filter sample recovery. Because the Winter and Annual sampling schedules overlapped in some instances, Table 5-4 also includes the data capture results for the Annual samples made during the 2-month Winter period.

The average data capture rates by filter type for the extra Winter IOP filter sampling were: b (FTC) = 96% and c (FQN) = 96%. The overall average for all of the Winter filter samples was 96 percent. The data capture rates for the Annual samples taken during the Winter study were: b (FTC) = 93%, c (FQN) = 94%, d (GIF) =96%, g (TCC) = 94%, and h (QNC) = 93%. The overall average data capture rate for all filter samples made during the Winter Program was 95 percent.

The PM sample recovery rates presented here represent successful sample installment, operation on schedule, and retrieval from the sampling sites. In addition, a valid sample required all the standard field operations procedures being followed, including handling and shipping between the analysis lab and the field site. The above rates are not reflective of the final recovery of Level 1 validated data, which will be determined by the DRI lab analysis results.

5.3.2 Nephelometer Monitoring

A summary of the data capture results for nephelometer measurements during the Winter Program are presented in **Table 5-4**. The table shows the percent of data capture determined by the ratio of the number of valid 5-minute averaged observations that were accomplished to the maximum observations possible. The actual number of observations possible depended on the availability of equipment, which varied from site to site. The results shown in the table are based on data recovered to Level 1 validation. Please refer to Section 7.1 of this report for a description of the nephelometer data validation results. Also, a more detailed site-by-site data recovery summary is presented in Appendix D of this report.

Table 5-3. MiniVol Filter Data Capture Rate CRPAQS Winter Program

Site	Type	Data Capture (%)
ACP	b	100
	c	100
ALT1	b	87
ANGI	d	67 (A)
BAC	d	80 (A)
BGS	g	80 (A)
	h	87 (A)
BODB	b	87
	c	93
BRES	b	93
	c	100 (A)
BTI	b	100 (A)
	c	100 (A)
	d	100 (A)
CARP	b	87 (A)
CHL	b	87 (A)
	c	47 (A)
	d	93 (A)
CLO	b	100
	c	100
COP	b	100
	c	100 (A)
	d	100 (A)
	g	100 (A)
	h	87 (A)
EDI	b	100 (A)
EDW	b	100 (A)
	c	100 A)
	d	100 (A)
FEDL	b	93
	c	100
	d	100 (A)
FEL	b	100
	c	100
	d	100 (A)
FELF	b	87
	c	100
FREM	b	93
	c	87
FRES	b	100
	c	100
	d	100 (A)
FSD	g	100 (A)
	h	93 (A)
FSF	d	93 (A)
HAN	g	93 (A)
	h	100 (A)
HELM	b	100
	c	87
	d	100 (A)
KCW	b	100

Note: A = Annual Sampling Only

Site	Type	Data Capture (%)
LVR1	b	100
	c	100
	d	100 (A)
M14	b	100
	c	100
	d	100 (A)
	g	100 (A)
	h	100 (A)
MOP	b	100 (A)
	c	100 (A)
MRM	b	100
	c	80
OLD	b	80 (A)
	c	73 (A)
	g	87 (A)
	h	80 (A)
OLW	b	73
	c	73
	d	93 (A)
PAC1	b	100 (A)
PIXL	b	93
	c	93
	d	100 (A)
PLE	b	100 (A)
	c	100 (A)
S13	b	100
	c	100
	d	100 (A)
SDP	d	100 (A)
SELM	b	100
	c	100
SFA	b	100
	c	100
SJ4	d	100 (A)
SNFH	b	100 (A)
	c	100 (A)
	d	100 (A)
SOH	b	93
	c	100
SWC	b	100
	c	100
TEH2	b	100
VCS	b	100
	c	100
	g	100 (A)
	h	100 (A)
YOSE	d	100

Table 5-4 gives the data capture rates for the additional 16 nephelometer sites operated during the Winter Program, and also the sites where ongoing Annual monitoring was taking place. The averaged capture rate for all of the exclusive Winter sites was 96 percent, and for the other Annual sites it was 97 percent. Note that only three nephelometer sites failed to achieve 90 percent data capture during the Winter Program period. Two were Annual sites (BODB and FRES), which experienced instrument malfunction, and one (ACP) was an exclusive Winter site. The data shortfall at the ACP site was due to a weak electrical power supply (solar generated) during the first half of the monitoring period.

Table 5-4. Nephelometer Data Capture for CRPAQS Winter Program

Site	Data Capture (%)	Site	Data Capture (%)
ALT	99 (A)	KCW	97
ACP	79	KRV	99 (A)
BAR	99 (A)	LVR	99
BOD	84 (A)	M14	94
BRE	99	MRM	99
BTI	99 (A)	OLD	99
CARP	97 (A)	OLW	99 (A)
CHL	99 (A)	PAC	99 (A)
CLO	99	PIX	99 (A)
COP	99	PLE	98
CRLD	99 (A)	SELM	99 (A)
DUB	99 (A)	SFA	85
EDI	99	SNFH	99 (A)
FEDL	93 (A)	SOH	99
FEL	99 (A)	SWC	98
FELF	99 (A)	TEH2	99 (A)
FREM	99 (A)	TEJ	97 (A)
FRES	86 (A)	VCS	99
HELM	99	WAG	99 (A)

Note: (A) = Annual Monitoring Only

5.3.4 Hydrocarbon Sampling

Hydrocarbon data capture rates must ultimately be based on the successful recovery of Level 1 valid HC data, which will be determined by OGI data validation results. The special time-resolved HC field sampling runs attempted at the BOBD site during IOPs were 100 percent successful. Two sampling runs that were tentatively scheduled for the early and mid morning of December 25th were not carried out for logistical reasons. The regularly scheduled 24-hour HC samples done at the three Annual sites (BODB, OLW and YOSE) were all successful (see Table 3-3**)**.

5.3.5 Rawinsondes

A total of 59 Rawinsondes were scheduled at each site. The dates and scheduled times are given in **Table 5-5**. As can be seen, additional soundings were taken if the minimum altitude (850 mb) was not reached or there was an excessive amount of missing data below that altitude. Soundings were made at all scheduled times at Fresno and Oakland NWS (the 12/18 at 2200 PST soundings were not scheduled). Bakersfield missed two of the scheduled soundings on January 6 and two on January 7 due to equipment problems that were eventually resolved. The soundings for the most part have valid data to 500 mb (~18,000 ft).

Vandenberg personnel mistakenly did not save the high resolution sounding data as requested and provided data only at 1000 ft increments, which is not of a vertical scale adequate to meet the needs of CRPAQS. T&B Systems has archived the Vandenberg data but it was not provided for inclusion into the CRPAQS database.

Table 5-5. Summary of Rawinsonde Observations (with T&B Systems file names) CRPAQS Winter Program

Date	Time (PST)	Fresno	Bakersfield	Oakland
12/15/2000	4	FSFD1504	BACD1504	OAKD1504
12/15/2000	10	FSFD1510	BACD1510	OAKD1510
12/15/2000	16	FSFD1516	BACD1516	OAKD1516
12/15/2000	22	FSFD1522	BACD1522	OAKD1522
12/16/2000	4	FSFD1604	BACD1604	OAKD1604
12/16/2000	10	FSFD1610	BACD1610	OAKD1610
12/16/2000	16	FSFD1616	BACD1616	OAKD1616
12/16/2000	22	FSFD1622	BACD1622	OAKD1622
12/17/2000	4	FSFD1704	BACD1704	OAKD1704
12/17/2000	10	FSFD1710	BACD1710	OAKD1710
12/17/2000	16	FSFD1716	BACD1716	OAKD1716
12/17/2000	22	FSFD1722	BACD1722	OAKD1722
12/18/2000	4	FSFD1804	BACD1804	OAKD1804
12/18/2000	10	FSFD1811	BACD1810	OAKD1810
12/18/2000	16	FSFD1816	BACD1816	OAKD1816
12/18/2000	22	None scheduled	None scheduled	OAKD1822
12/26/2000	4	FSFD2604	BACD2604	OAKD2604
12/26/2000	10	FSFD2610	BACD2610	OAKD2610
12/26/2000	16	FSFD2616	BACD2616	OAKD2616
12/26/2000	22	FSFD2622	BACD2622	OAKD2622
12/27/2000	4	FSFD2704	BACD2704	OAKD2704
12/27/2000	10	FSFD2710	BACD2710	OAKD2710
12/27/2000	16	FSFD2716	BACD2716	OAKD2716
12/27/2000	22	FSFD2722	BACD2722	OAKD2722
12/28/2000	4	FSFD2804	BACD2804	OAKD2804
12/28/2000	10	FSFD2810	BACD2810	OAKD2810
12/28/2000	16	FSFD2816	BACD2816	OAKD2816
12/28/2000	22	FSFD2822	BACD2822	OAKD2822
01/04/2001	4	FSFJ0404	BACJ0404	OAKJ0404
01/04/2001	10	FSFJ0410	BACJ0410	OAKJ0410

Table 5-5. Summary of Rawinsonde Observations (with T&B Systems file names) CRPAQS Winter Program

Date	Time (PST)	Fresno	Bakersfield	Oakland
01/04/2001	16	FSFJ0416	BACJ0416	OAKJ0416
01/04/2001	22	FSFJ0422	BACJ0422	OAKJ0422
01/05/2001	4	FSFJ0504	BACJ0504	OAKJ0504
01/05/2001	10	FSFJ0510	BACJ0510	OAKJ0510
01/05/2001	16	FSFJ0516	BACJ0516	OAKJ0516
01/05/2001	22	FSFJ0522	BACJ0522	OAKJ0522
01/06/2001	4	FSFJ0604	BACJ0604	OAKJ0604
01/06/2001	10	FSFJ0610	BACJ0610	OAKJ0610
01/06/2001	16	FSFJ0616	Equipment	OAKJ0616
01/06/2001	22	FSFJ0622	Equipment	OAKJ0622
01/07/2001	4	FSFJ0704	Equipment	OAKJ0704
01/07/2001	10	FSFJ0710	Equipment	OAKJ0710
01/07/2001	16	FSFJ0716	BACJ0716	OAKJ0716
01/07/2001	22	FSFJ0722	BACJ0722	OAKJ0722
01/31/2001	4	FSFJ3104	BACJ3104	OAKJ3104
01/31/2001	10	FSFJ3110	BACJ3110	OAKJ3110
01/31/2001	15	FSFJ3115	None scheduled	None scheduled
01/31/2001	16	FSFJ3116	BACJ3116	OAKJ3116
01/31/2001	22	FSFJ3122	BACJ3122	OAKJ3122
02/01/2001	4	FSFF0104	BACF0104	OAKF0104
02/01/2001	10	FSFF0110	BACF0110	OAKF0110
02/01/2001	16	FSFF0116	BACF0116	OAKF0116
02/01/2001	22	FSFF0122	BACF0122	OAKF0122
02/02/2001	4	FSFF0204	BACF0204	OAKF0204
02/02/2001	10	FSFF0210	BACF0210	OAKF0210
02/02/2001	16	FSFF0216	BACF0216	OAKF0216
02/02/2001	22	FSFF0222	BACF0222	OAKF0222
02/03/2001	4	FSFF0304	BACF0304	OAKF0304
02/03/2001	10	FSFF0310	BACF0310	OAKF0310
02/03/2001	16	FSFF0316	BACF0316	OAKF0316
02/03/2001	22	FSFF0322	BACF0322	OAKF0322
			BACF0323	

6.0 QUALITY ASSURANCE

Prior to the start of the CRPAQS field monitoring, a Quality Integrated Work Plan (QIWP) was prepared which formed the basis for quality assurance (QA) procedures utilized in the Satellite Network measurements. There were two key categories of QA assessment that were performed during the operation of the CRPAQS Satellite Network Program; internal review and external audits. The internal review process was ongoing during all phases of the project and performed by T&B Systems and Parsons staff. It consisted of a series of operational quality control (QC) measures conducted routinely in order to ensure that the entire data acquisition process resulted in the collection of a database of known quantity. In addition, the services of Air Resources Specialists (ARS) were contracted by T&B Systems to provide an independent internal review of the systems and equipment operations. External reviews were performed by the CRPAQS Quality Assurance team and took the form of independent outside audits.

To develop an understanding of the uncertainty of the nephelometer measurements made in the Satellite Network Program, a series of instrument intercomparison trials were conducted in the field and at the T&B Systems facilities in Santa Rosa, CA. The Radiance Research nephelometers are a relatively new instrument and there were only limited performance evaluations prior to these tests. In addition, the nephelometers were operated in a variety of configurations during CRPAQS, each of which may affect the b_{sp} measurement. The results of these intercomparison trials are presented below in Section 6.3 of this report.

6.1 Operational Quality Control

The primary operational strategy employed for the field data acquisition operations of the CRPAQS Satellite Program was to accomplish the measurements utilizing experienced field technicians operating out of field office facilities centrally located in three sectors of the sampling network. Routine site servicing, handling and temporary storage of samples and data, and shipping were funneled through the field offices located in Bakersfield in the south, Modesto in the central sector, and Dixon in the northern area. In addition, experienced technicians provided equally proficient services at sites that were isolated from the main network sectors (i.e., BODB, OLW, SJ4, and YOSE).

All field technicians performed field operations by carefully following the prescribed SOPs set forth in the QWIP at the onset of the program. Every site visit included the filling out of forms that served to document the condition of the operations, the pertinent technical information such as flow rates, and times of operation, and served as chain-of-custody documentation when transfer of samples or data took place. In this manner, the site service sheets also served as a more efficient and objective substitute for individual site log books, and also worked as an operational checklist for the operators to follow in order to insure that all procedures were completed.

6.1.1 Filter Sampling

During each scheduled site visit, field technicians removed exposed filters and installed fresh ones, performed routine site maintenance, recorded equipment performance information (flow rates, run time, date/times, filter IDs, site condition), and current weather/visibility conditions. The SOPs and examples of site visit forms used by the technicians are given in Appendix B of this report.

Filter packs were kept cold during transit to and from both the DRI analysis laboratory in Reno NV, and the sampling sites. Cold storage was also provided while filters were in the field offices awaiting installation. Shipments back to the DRI lab were usually done after every two sampling cycles. Most of the samples were transported to DRI via the personal vehicle of a field technician who lives in Reno, Nevada. In this manner, the technician maintained the integrity of the samples. In some instances, commercial carrier overnight service was utilized for sample shipment. In those cases, the samples were securely packed in insulated containers with blue ice, and chain-of-custody documentation accompanied the shipment.

Routine site maintenance performed by T&B Systems field technicians included periodically cleaning sampling inlets when required; checking flows; checking instrument date and time settings; and replacing battery packs.

6.1.2 Nephelometer Operations

As a part of Quality Assurance procedures, standard operating procedures and check sheets were followed during each site visit and data download. Examples of the nephelometer routine servicing forms are given in Appendix B. The forms were completed by the field technicians during each site visit and served as a performance and maintenance record for each instrument, as well as documentation of site log information. Zero and span calibration runs were also documented on standard field forms. Appendix B presents examples of these forms as well.

Routine site maintenance performed by T&B Systems field technicians as required included periodically cleaning sampling inlets; checking flows; checking instrument date and time settings, as well as the operational parameters as displayed by the instrument to insure that the unit was still functioning properly; checking and/or ensuring that data logging programs were started and in ready mode; and performing minor repairs.

The 5-minute averaged nephelometer data that were downloaded by the field technicians during the site visits were transferred to T&B Systems via the Internet at the completion of each service day or copied to diskette and mailed accompanied by the associated paperwork. After an initial Level 0 Quality Control check in the field by the T&B Systems Project Field Manager, the time-series of Level 0 data were plotted and reviewed by the T&B Systems Project Manager. Trends in the network operations were recognized during this procedure that aided in the identification of malfunctioning equipment. The Level 0 data were then processed and further validated by the T&B

Systems Data Manager and staff. The SOP's for the data validation process are presented in Appendix B and discussed in Section 7 of this report.

6.1.3 Hydrocarbon Sampling

T&B Systems field technicians were responsible for collecting ambient air samples for analyses of HC composition using stainless steel canisters at three sites (BODB, OLW, YOSE). The technicians followed the SOP prescribed by OGI in Beaverton OR. Documentation of operational procedures performed during each site visit was recorded on site visit forms, which were filled out by the technicians. The sampling canisters were stored at the individual field offices, and then shipped via commercial carrier to the OGI laboratory for analysis. Chain of custody documentation was included in the shipments. The SOP's and examples of the site visit forms appear in Appendix B of this report.

6.1.4 Rawinsonde Operations

Standard operating procedures were followed that included checksheets and pre-sounding information, both for initial and final sonde conditioning and checkout. The SOP and standard forms are shown in Appendix B.

Ground-level comparisons between the sonde readings and station and/or independent instrumentation were made prior to each launch. Station pressure, ambient temperature, relative humidity, wind direction and wind speed were recorded at release time and compared to sonde values. Typically, biased or faulty sensors are identified in this manner prior to balloon release. This "ground truth" reading provided confirmation that the sensors were correctly functioning in the event readings aloft were questioned during analyses.

Immediately after completion of the soundings, the data were processed into engineering units and stored in ASCII files that could be easily reviewed by the operator. The operator was instructed to review each sounding to ensure the sounding was complete and the equipment was operating properly. The processed and raw files were immediately copied to diskettes.

During post-processing and data validation, an experienced meteorologist reviewed each sounding. Each measured and computed parameter (height and dew point temperature) was plotted and examined for internal consistency (temperature lapse rates, balloon ascension rates, data spikes, etc.) In this manner, outliers and unusual sensor behavior were identified.

6.2 Calibrations and Audits

Perhaps the most important factor that affects the amount, precision and accuracy of recovered monitoring data and field samples is the proper functioning of field equipment. In the CRPAQS Satellite Network Program, the primary instruments were

Airmetrics MiniVol samplers and Radiance Research nephelometers. A critical part of the project Quality Assurance program was the internal and external quality assessment checking made on the primary equipment and their operators. The checks were made in the form of a series of field calibrations and audits conducted periodically during the course of the program. Calibration of hydrocarbon and Rawinsonde equipment was left to the manufacturers.

Following is a review of the equipment checking activities that took place during the CRPAQS Satellite Network Program.

6.2.1 Acceptance Tests

Prior to the beginning of field monitoring operations, ARS was commissioned by T&B Systems to perform Acceptance Testing on all the MiniVols and nephelometers to be used in the program. The equipment was sent directly from the suppliers to the ARS facilities in Fort Collins, CO. There they were bench tested at ambient indoor temperature, humidity and pressure (near 6000 ft above sea level) of the laboratory. The primary purpose of the testing was to determine that each instrument was operating according to the manufacturers specifications, and to repair any malfunctions encountered. Although the intent of the acceptance testing was not to provide an initial calibration database, flow set points for each MiniVol were established, and zero/span adjustments were made on each nephelometer. Acceptance testing continued at the ARS facility well after the start of the field operations phase of the project, in order that equipment delivered later from the suppliers could also be tested before being installed in the field. No written report documenting the set points and zero/span checks was required.

6.2.2 Internal Calibrations

Upon arrival in the field, the flow set points for the MiniVols were checked indoors at the Modesto field office before installation at field sites. The results of those checks were documented and are archived at T&B Systems. Periodic unscheduled field checks of MiniVol flow set points were made by T&B Systems field technicians as required during the duration of the field program. Set point checks were also conducted indoors at the Angiola field facility just prior to the start of the Fall Saturation Project. Documentation from those calibrations are archived at T&B Systems.

When installed, all nephelometers underwent a two point zero/span field calibration at their initial site locations. T&B Systems field technicians were responsible for performing the initial infield zero/span calibrations and all others performed for the duration of the program. The calibrations were performed using a zero air filter, and freon 134A (SUVA) calibration gas as a standard. Appendix B of this report contains the SOP's for the zero/span field calibrations. Up to three zero/span calibrations were carried out on each nephelometer during the initial stages of the Satellite Program in order to determine if the instruments maintained calibration. Additional field calibrations were conducted when an instrument was moved to a different site, or when a period longer than six weeks had elapsed since the previous calibration. The results of the nephelometer field calibrations are presented in **Appendix F** of this report.

6.2.3 Internal Audits

ARS conducted two extensive internal audits in the field during the field operations period of the Satellite Program. The first audit was conducted from May 22 to June 3, 2000 and the second was from November 29 to December 8, 2000. ARS has submitted two written reports to T&B Systems containing the results of the internal audits (ARS 2000; ARS 2001).

ARS field technicians conducted flow calibration checks and adjusted the set points as required on all the MiniVols operating in the field. Periodic changes in set points were required to account for seasonal variations in ambient meteorology. The ARS auditors also checked the T&B Systems field operators to determine compliance with the SOPs. The results of the MiniVol flow calibrations are included in **Appendix E** of this report.

The ARS auditors also performed calibrations (zero and SUVA gas) on the Radiance Research nephelometers operating in the field during their two visits. In addition, they also checked the field technicians' compliance with the nephelometer SOP's. The calibration data from these instrument audits are included in Appendix F of this report.

6.2.4 External Audits

CRPAQS Project quality assurance contractor conducted external audits of operation, both in the field and post-field data processing operations. The audits evaluated both the performance of the equipment, and the entire data acquisition and validation systems. Calibration checks of nephelometers and MiniVol flow set points were made during the site audits. One audit was conducted in the Corcoran area at the beginning of the Fall Saturation Project, and included only sites involved in that study. The results of the audit have been submitted to the CRPAQS Program under separate cover (Bush, 2002). A second field audit was conducted in the Satellite Network at the beginning of the Winter Program (Bush, 2002). The results of the MiniVol flow set point calibrations from the two external audits are included in Appendix E of this report. Calibration data for the nephelometer audits are available in Appendix F of this report.

In addition to the field audits, an external systems audit of the data handling and validation procedures was conducted at T&B Systems after the completion of the field program. The results of that audit have also been submitted to CRPAQS (Bush, 2002).

6.3 Nephelometer Intercomparisons

6.3.1 Nephelometer Intercomparison - Angiola

At the completion of the field study, four nephelometers that had been operating at various sites were brought to Angiola and, along with the existing unit, were collocated and operated for 11 days (from February 9 to 20, 2001). The five nephelometers were time-coordinated, pressure set uniformly, and calibrated prior to the start of the comparison testing. **Table 6-1** includes the nephelometer serial numbers, the sites where they were operating at the close of the field study, any pertinent notes, and the pre-test calibrations. The units' *time in service,* which can be inferred from the serial numbers, ranged from the start of the project to those received for service in the Fall Project. Unit 292, which was operated at the Feedlot/dairy (which was a particularly dusty site) and two other nephelometers that had operated at the same site, all became problematic after being installed at the site. All five nephelometers being compared at Angiola were configured similarly in that insulation jackets were installed, and the heaters and fans were reversed from the factory configuration. Unit 305 had a DC heater controller rather than the more common AC heater controller. As noted in the table, the Feedlot unit (292) had a fast clock which gained approximately 1 minute/day.

Table 6-1. Collocation Test Results, Angiola, February 9 to 20, 2001

Serial No.	Location From	Remarks	Zero	Slope
227	SNFH		-0.6 Mm^{-1}	.989
262	ANG		+5.1 Mm^{-1}	.917
292	FEDL	Fast Clock	+4.1 Mm^{-1}	.980
305	ACP	DC Heater	+0.4 Mm^{-1}	.968
312	KRV		-1.1 Mm^{-1}	1.029

Figure 6-1 shows the time-series of b_{sp} Level 0 5-minute averaged measurements for the first two complete days of the intercomparison test. As can be seen, the measurements are perfectly correlated with each other and, in terms of light scattering values, remarkably comparable considering the instruments were not reset to a slope of 1.0 and zero based on the pre-test calibrations. The largest differences between units were on the order of 10 Mm^{-1} or about 10 percent.

In **Figure 6-2**, the same period (as in Figure 6-1) is shown for the data after the calibrations are applied. As can be seen, the measurements are nearly equal. Unit 305 (with the DC heater controller) appears to measure slightly lower than the others in some instances.

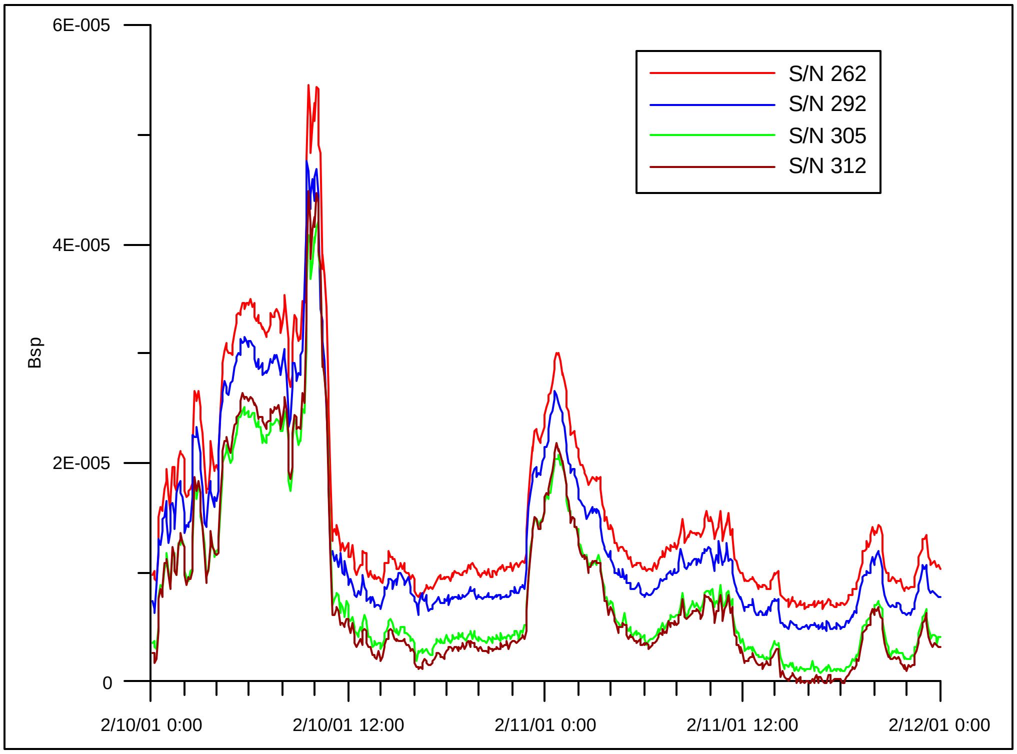


Figure 6-1. Collocated Measurements of Level 0 b_{sp} - Angiola Tests

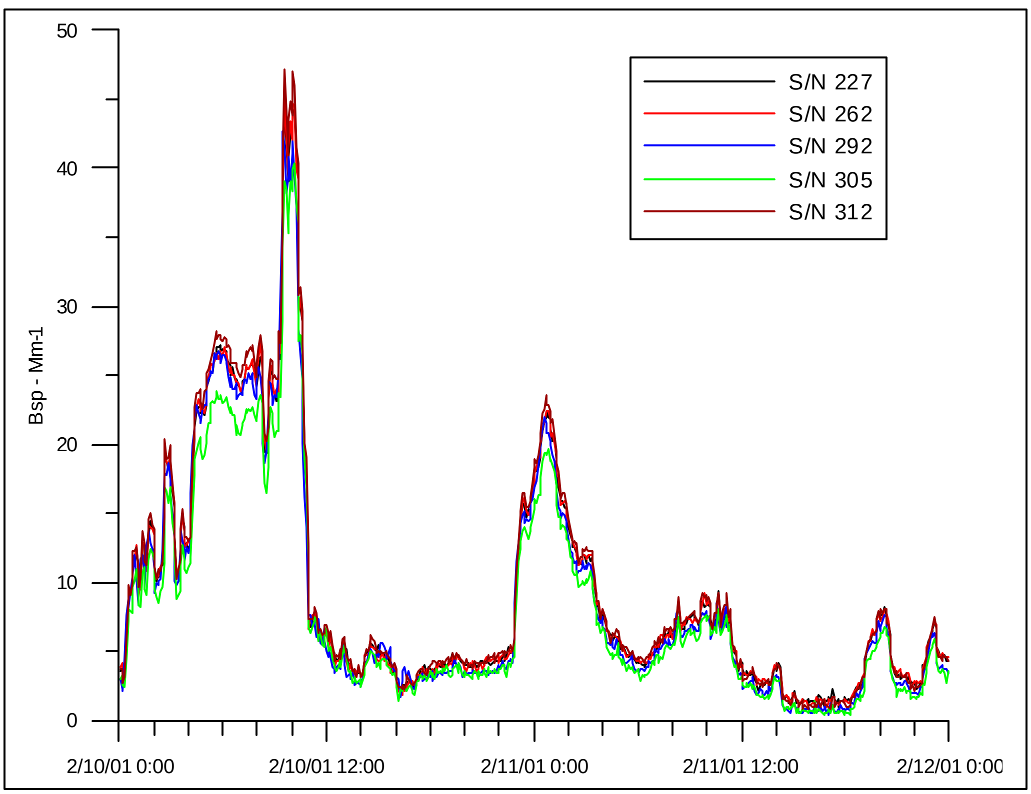


Figure 6-2. Collocated Measurements of Level1 b_{sp} - Angiola Tests

The time-series of relative humidity (RH) over the same two-day period is shown in **Figure 6-3** for the five units. RH varied from 45 to over 70 percent. The heater controllers were designed to limit the RH to 65 percent but in practice the cut-point was around 70 to 73 percent. Ambient air was being heated at high relative humidity to eliminate the liquid water component to the total light scatter. Note that RH as measured by unit 305 appears slightly lower than the other units at values near the cut-point. Light-scatter levels show corresponding decreases (see Figure 6-2). Because the onset of acquiescence occurs within this range of humidity, relatively small differences may cause disproportionally large differences in light scatter. This is graphically depicted in **Figure 6-4** which shows the b_{sp} difference (between units 227 and unit 305) as a function of RH.

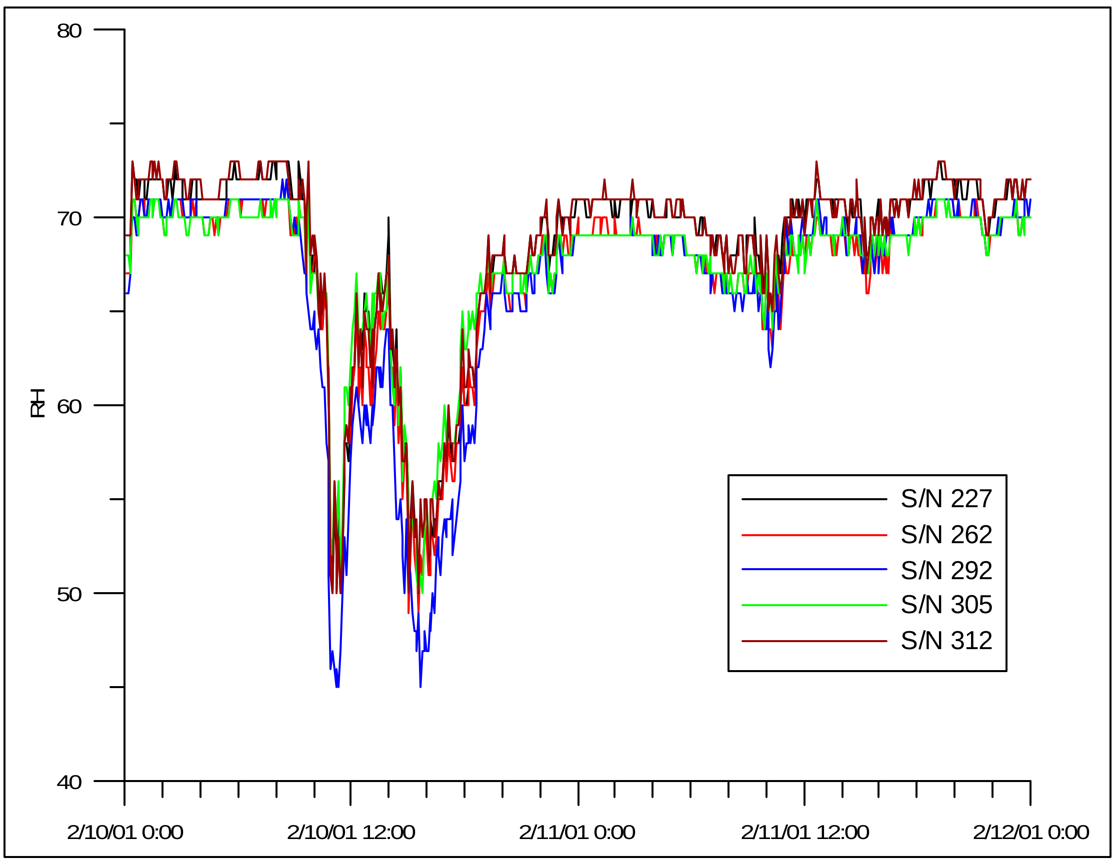


Figure 6-3. Collocated Measurements of Relative Humidity - Angiola Tests

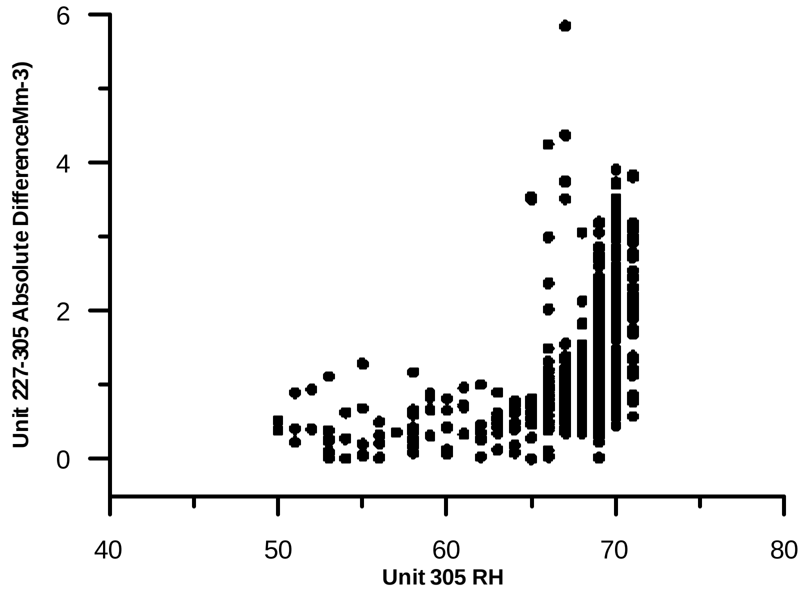


Figure 6-4. Difference Between b_{sp} Versus Relative Humidity- Angiola Tests

Statistics summarizing the intercomparison measurements for the 10-day period February 10 to 20 are given in **Table 6-2**. Statistical parameters reported are the average absolute difference between the b_{sp} measurements from Unit 227 and the other nephelometers, the standard deviation of the differences, and the maximum differences (in Mm^{-1}). Statistics are included for both the uncorrected and corrected readings.

Differences between the measurements prior to calibrations being applied (uncorrected) ranged from less than 1 to 9 Mm^{-1} (Unit 227-Unit 262). With calibrations applied, differences ranged from 1 to 3 Mm^{-1}. Standard deviation of the differences ranged from 1 to 4 Mm^{-1}. The maximum difference between Units 227 and 292 (the Feedlot) were exceedingly high both with the uncorrected and corrected data sets (~60 Mm^{-1}).

Table 6-2. Summary Statistics - Intercomparison

	Unit 227-262	**Unit 227-292**	**Unit 227-305**	**Unit 227-312**
Level 0 data				
Avg. of Absolute Differences	9.43	4.42	2.32	0.79
Standard Dev.	3.76	3.20	2.67	0.74
Maximum Difference	24.58	63.30	14.60	6.79
After Calibrations Applied				
Avg. of Absolute Differences	0.77	2.29	3.36	2.11
Standard Dev.	3.78	3.38	2.68	0.75
Maximum Difference	10.35	56.61	18.94	11.94

The 10-day time-series of the differences in the 5-minute averages are shown on **Figure 6-5**. Light scatter as measured by unit 227 (our arbitrary standard) is included. Two features are noteworthy. First, differences between units are related to the magnitude of light scattering. Thus, even after applying calibrations there is still a scaling error. The second feature to note is the increasing difference between units 227 and 292 with time (spikes). Recall that unit 292 gains 1 minute/day, thus by February 15 this nephelometer was more than 5 minutes fast. Five-minute averages from unit 292 became totally out of synch with the other units. If light scattering varies significantly between 5-minute intervals, differences between units will be depicted as a spike in the figure. As can be seen, a number of large spikes are evident.

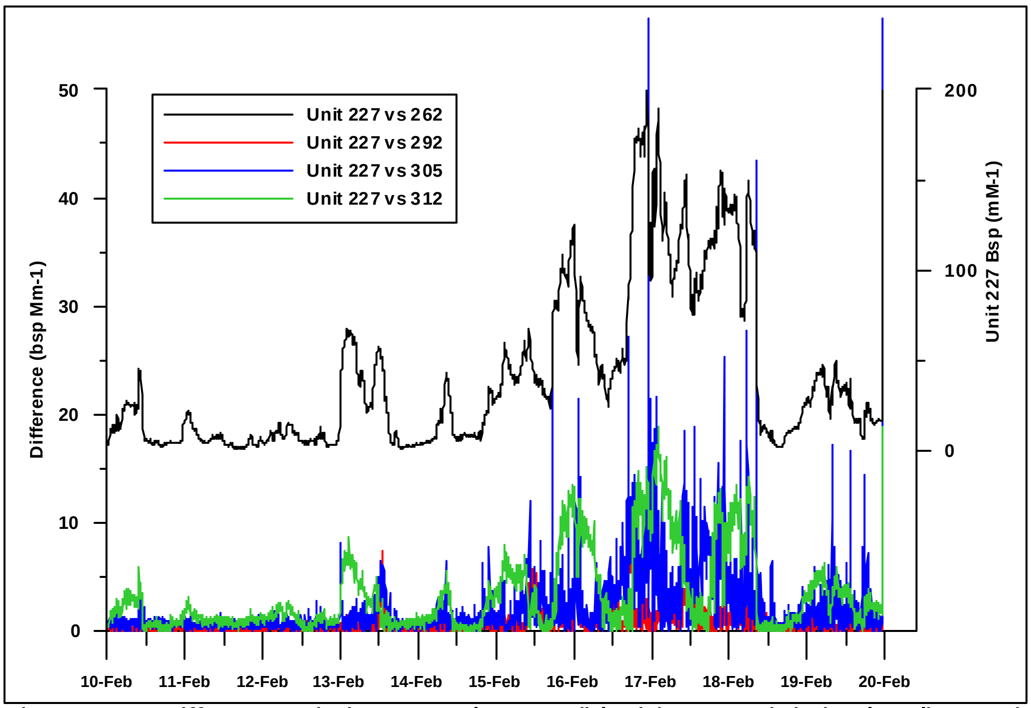


Figure 6-5. Differences in b_{sp} - Level1 Data (black/top graph is b_{sp} level) - Angiola

Time-series of light-scatter levels for the five nephelometers over a 3-hour period are shown on **Figure 6-6**. Each 5-minute average is clearly discernible on this scale. Beginning at 2300, b_{sp} levels show large record-to-record variability. It is evident that all nephelometers are in phase except unit 292. High and low levels as measured by unit 292 appear to lag one record (averaging interval) behind the other nephelometers. Applying a linear time-correction to the time mitigates this problem. This technique was subsequently applied to all of the instruments that exhibited clock errors.

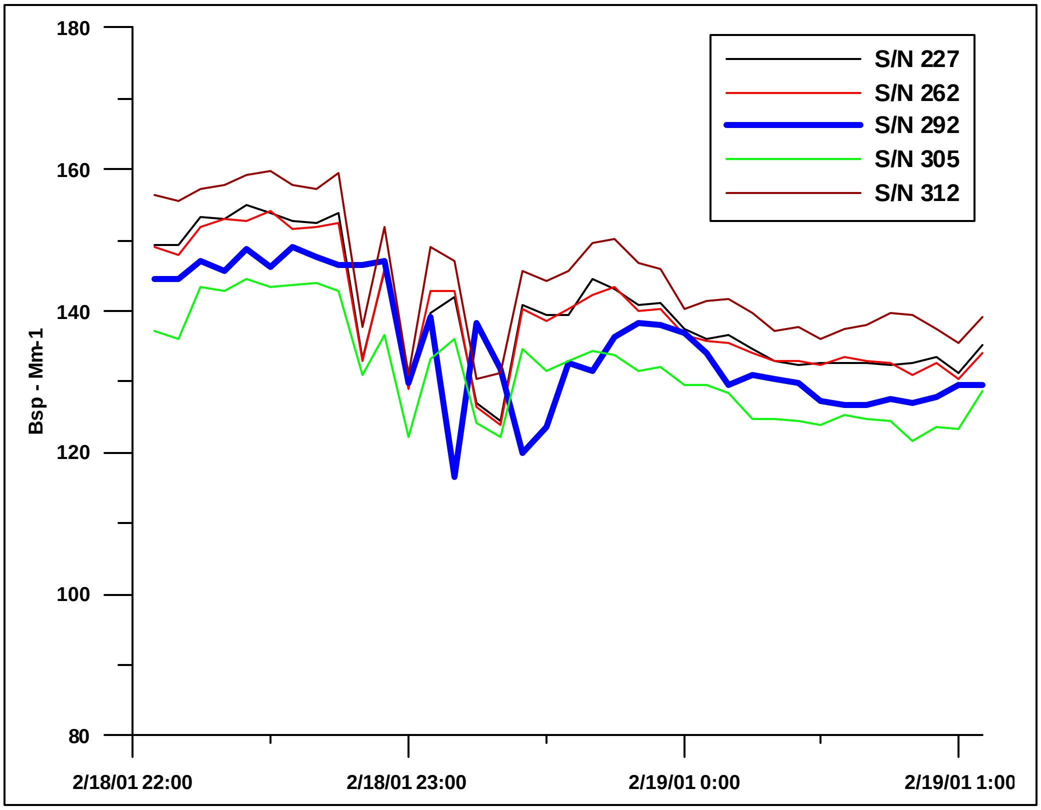


Figure 6-6. Showing Time Lag on Unit 292 - Angiola Tests

6.3.2 Santa Rosa Intercomparison

Three nephelometers all configured differently were collocated at the T&B Systems offices for several days after the conclusion of the field study. One unit (248) was in the final field-configuration with insulating jacket, fan reversed, etc. A second unit (318) was the original design configuration (i.e., no insulating jacket with a heater/controller). A third unit (317) was the "barebones" configuration, which used a low-wattage light bulb rather than a heater/controller to heat the inlet air and did not have an insulating jacket. Data without calibrations applied (Level 0.5 data validation) were used in the following analysis.

The objective of this intercomparison was to determine how the operating characteristics of the Radiance Research nephelometer varied when configured differently. All three configurations comprised the units used in the field study. The "barebones" configuration was utilized initially in the study before the heater/controllers were deployed to the field, and when heater/controllers were inoperative. The original design configuration was the most common mode in which the nephelometers were operated during the study. Largely as a result of differences observed at the Angiola tower during the study, it was determined that the temperature and relative humidity (RH) of the air in the nephelometer sampling chamber may not be the same as the measured readings that also controlled the heater (those sensors were located in the inlet). Consequently, the air could conceivably be cooler and more humid than the design values. To correct this potential source of error, an insulating sleeve was installed over the body of the instrument to keep the air from being cooled in the sample chamber and the inlet/exhaust ports were reversed so that temperature and RH were being measured closer to the sampling chamber. This field modification was accomplished prior to the start of the Winter Program.

The first plot **(Figure 6-7)** compares the RH as measured by the two units with heaters and controllers; one with heater at the inlet and the other in the exhaust port. The best-fit line is also shown (red). As can be seen, the relationship is very close to unity (1.015) and does not indicate any bias one way or another. It appears measurements are not affected by reversing the inlet/outlet heater ports.

Figure 6-8 shows a comparison of RH as measured by the two units without insulating jackets; one with a heater/controller (unit 317) and the other configured with a light bulb. As can be seen, the light bulb unit RH was consistently less than the other unit until levels of 68 percent were experienced and the heater kicked in.

In the next two figures, b_{sp} differences as a function of RH are examined. **Figure 6-9** shows the relationship between the two units with heater controllers, and **Figure 6-10** the non-jacketed units with and without light bulbs. Note that in the first combination, b_{sp} differences average about 6 to 7 Mm^{-1}. The actuality of the disparity is inconclusive as it could be due to calibration differences rather than configuration differences. Note the large spike in b_{sp} differences occurring around 65 percent RH—which is the threshold for activating heaters. It appears from the data examined that the original configuration did not introduce significant biases in b_{sp} and met the objectives of the study.

The last figure (Figure 6-10), comparing b_{sp} differences between the unit with the light bulb and heater unit with no insulating jacket, shows the former set of measurements biased to lower b_{sp} readings with the difference increasing with increasing RH. The data depicted in Figures 6-6 to 6-8 show that RH is consistently lower due to the light bulb continuously heating the air. Since aqueous chemistry is thought to become significant when humidity is >65 percent, it is suggested that the nephelometer measurement is sensitive to temperature. Temperature uncertainties are due to either variation in the heater/controller characteristics or warming of the air in the sampling chamber.

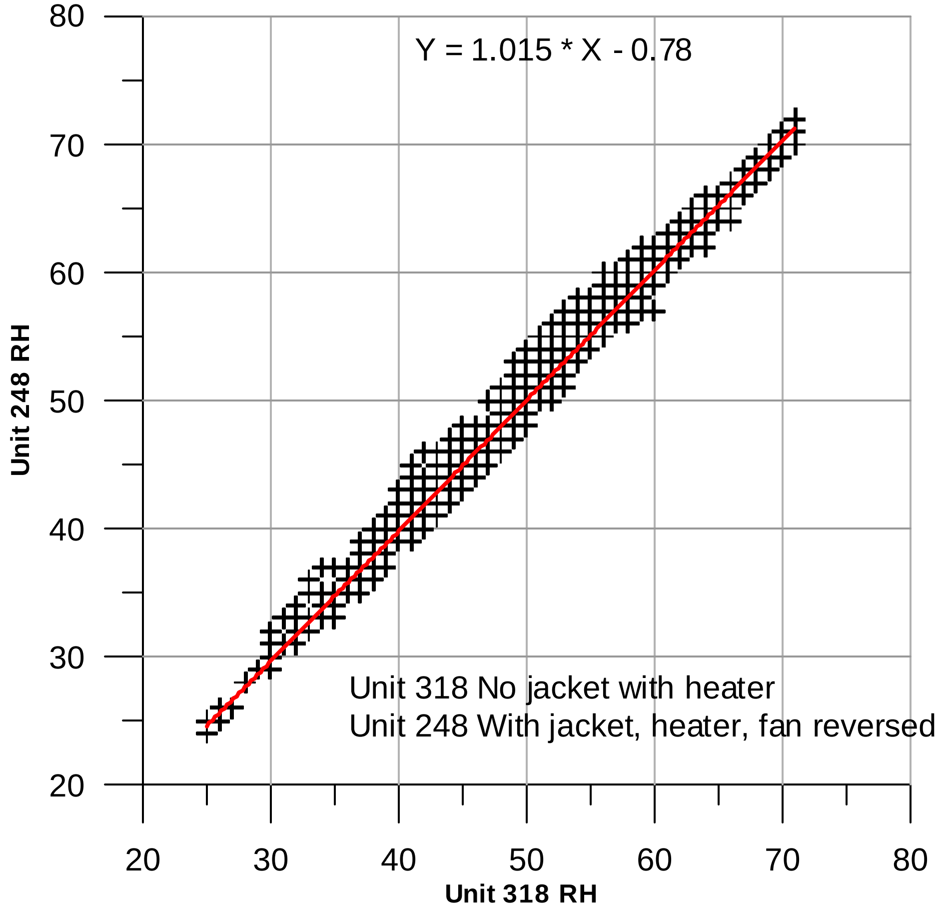


Figure 6-7. Comparing RH Measured by Nephelometers With and Without an Insulating Jacket – Santa Rosa Test

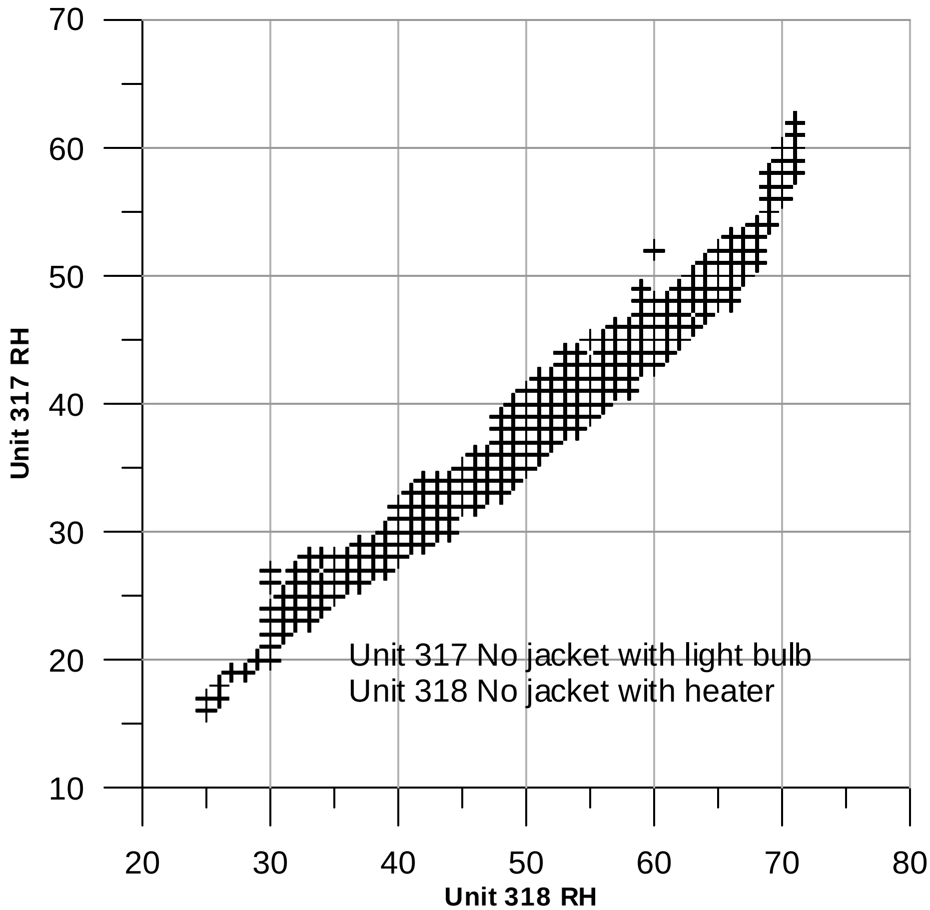


Figure 6-8. Comparing RH Measured by Nephelometers With and Without Heater/Controller - Santa Rosa Test

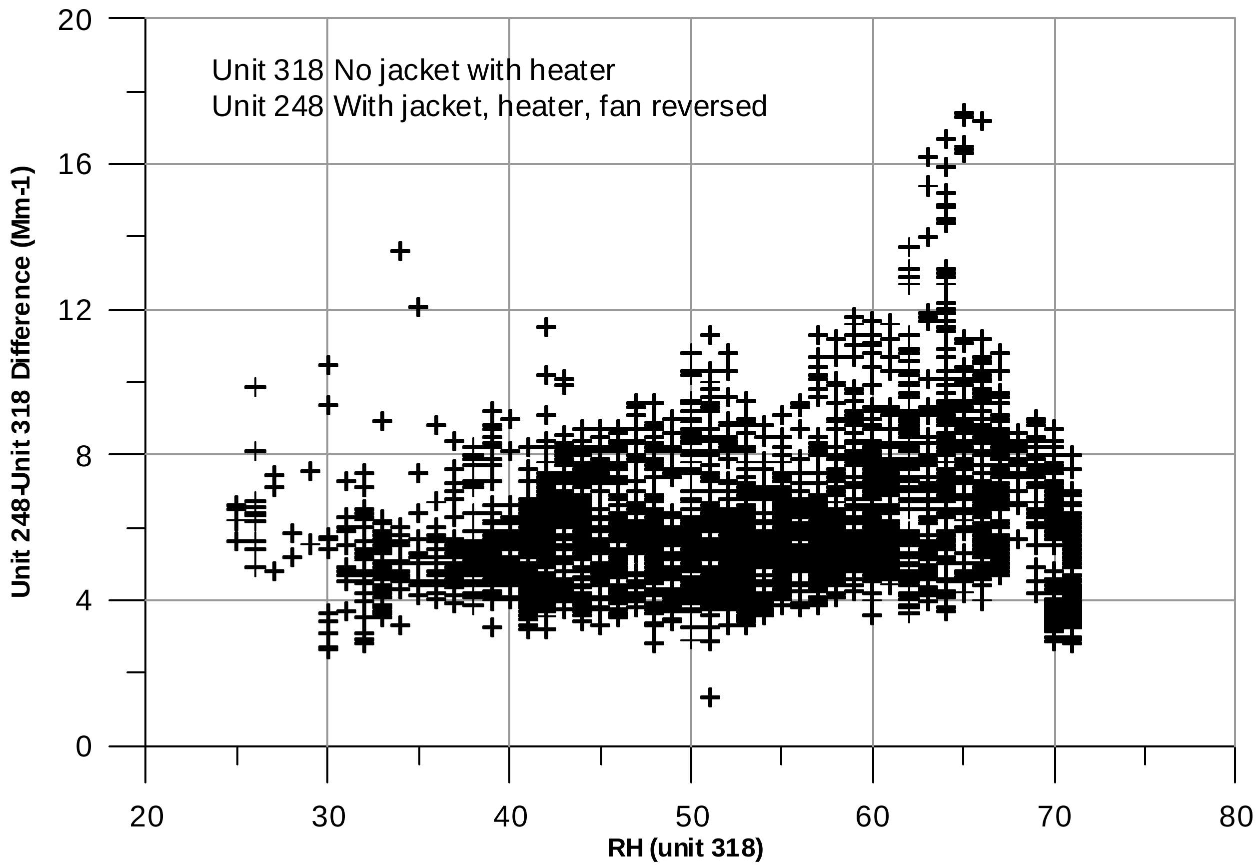


Figure 6-9. Differences in b_{sp} as Measured With and Without Insulating Jackets – Santa Rosa Tests

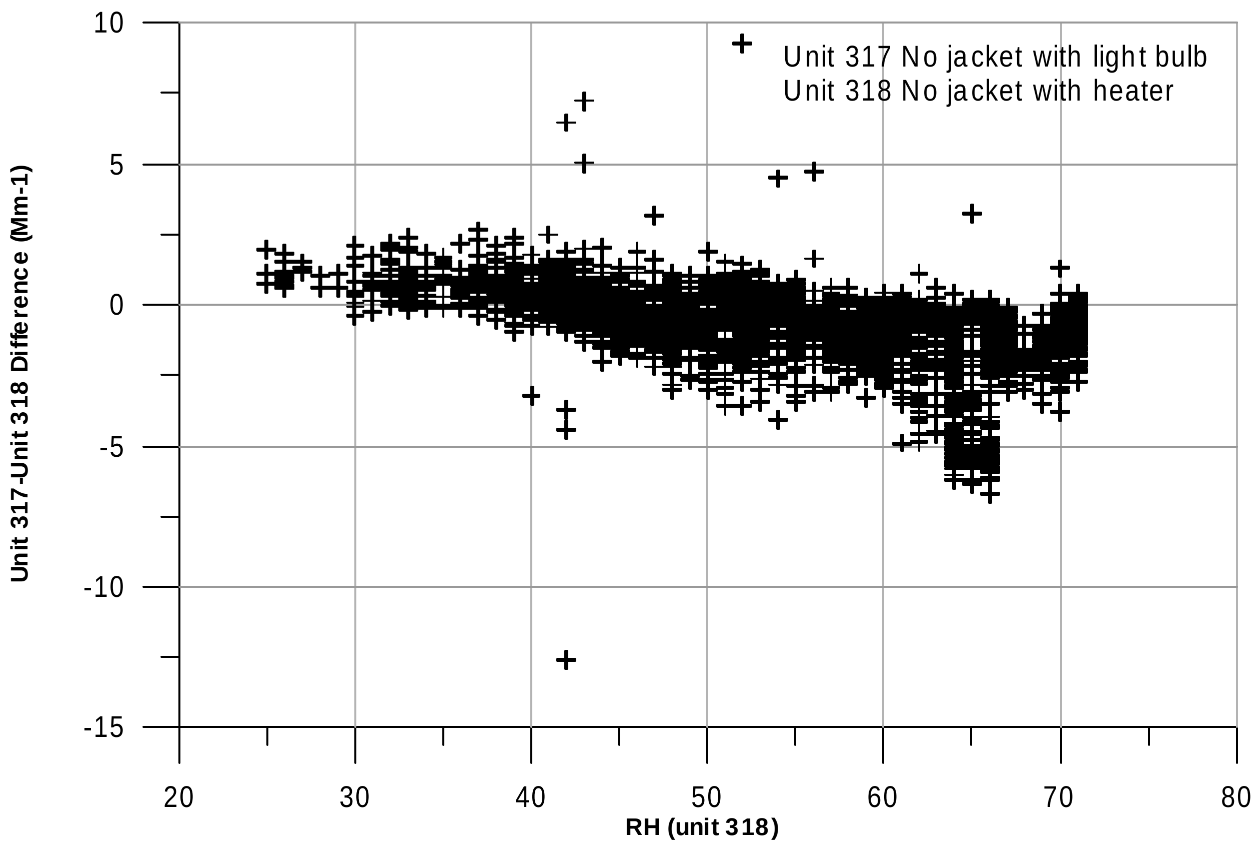


Figure 6-10. Differences in b_{sp} as Measured With and Without Heater/Controller - Santa Rosa Tests

7.0 DATA REPORTING

T&B Systems carried out four different types of field measurements during the CRPAQS Satellite Network Program:

- MiniVol particulate filter measurements (PM),
- Hydrocarbon sampling (HC),
- Rawinsonde upper-air meteorological measurements, and
- Nephelometer (b_{sp}) monitoring.

MiniVol and hydrocarbon measurements involved the collection of field samples that were subsequently sent to other program participants for laboratory analysis. T&B Systems staff documented the field operations activities associated with those measurements, but the resultant data sets are provided to the CRPAQS Program Data Manager by the applicable laboratory. Flow rate calibrations of the MiniVols were the responsibility of T&B Systems, and are described in Section 6.2. The calibration results are presented in tabular form in Appendix E.

Nephelometer and rawinsonde data have been presented to the CRPAQS Data Manager in electronic format in accordance with the prescribed data format protocol. Calibration of the nephelometers was the responsibility of T&B Systems, and is discussed in Section 6.2 of this report. All program nephelometer calibration results are listed in tabular form, by instrument serial number, in Appendix F. The results of several nephelometer intercomparison tests are presented in Section 6.3 of this report.

7.1 Data Processing and Validation

Data validation protocol used for the CRPAQS Satellite Network Program is defined by Watson, et al. (1998) as a three-level process that should be mandatory in any environmental measurement study. Data records are designated as having passed these levels by entries included with each data record. These levels, and the validation codes that designate them, are defined as follows:

<u>Level 0</u>
These data are obtained directly from the data loggers that acquire data in the field. Averaging times represent the minimum intervals recorded by the data logger, which do not necessarily correspond to the averaging periods specified for the database files. Level 0 data have not been edited for instrument downtime, nor have procedural adjustments for baseline and span changes been applied.

Level 1
These data have passed several validation tests applied by the measurement investigator prior to data submission. The general feature of Level 1 procedure is the flagging of data when significant deviations from measurement assumptions have occurred.

Level 2
These data are subjected to cross comparison with other data from nearby data sources. In addition, calibration corrections are applied to the data if appropriate.

7.1.1 Nephelometer Measurements

All nephelometer data collected by T&B Systems during the field operations phases of the Satellite Program have been processed to Level 1 data validation. All stages of the Level 1 validation process are described in the Validation Procedures section of the SOP's presented in Appendix B of this report.

Nephelometer data processing and validation milestones have been documented using two forms, examples of which appear in Appendix B. These forms serve to outline the specific steps followed in the data validation process. The actual completed forms are archived at T&B Systems. Detailed descriptions and clarification of procedures are presented below.

Level 0
Raw electronic data files, and accompanying site visit documentation forms, were assembled and checked for continuity upon initial arrival from the field. Pertinent information was marked at that time for flagging later in the actual data files. The data was then merged into a "master" computer file before being forwarded to the CRPAQS Satellite Network Data Manager for combining and Level 0.5 processing.

Level 0.5
All of the Level 0 data was then processed into Level 0.5 form by the CRPAQS Satellite Network Data Manager. Level 0.5 processing included objective computer screening to flag and mark as "suspect" b_{sp} data outside an established set of ranges; RH greater than 75 percent or less than 7 percent (except summertime desert sites), and temperature lower than 260^o K or greater than 325^o K. Gaps in data continuity were identified and that data flagged as missing. All b_{sp} readings were converted from units of m^{-1} to units of Mm^{-1}. Excel spreadsheet work files were created along with time-series plots from the processed data. Those files were then considered to be Level 0.5 data files. The files were then marked as milestone version "A" and forwarded to the T&B Systems personnel responsible for further processing.

Working "duplicates" of the files were made and identified as milestone version "B." At this point, the process of detailed validating began and all field observation notes were applied. The data were then manually reviewed and appropriately flagged. All flagging information entered into the data set was documented on an internal log depicted in Appendix B. The flags used were agreed upon with the CRPAQS Data Manager in a system of primary/secondary flags and codes that were assigned to particular situations that might affect the data quality or utility.

The manual review and validation proceeded on the assumption that all data was valid (primary flag V0), but with some mitigating circumstance that might have an impact (primary flag V1) on the data utility for some users. Based on the documented situational changes at the site, data could be set as missing, suspect or invalid; data was flagged with an M, S or I, with details for the status given in the comments column.

When version B required successive revisions by data validation technicians, the versions were renamed each time a new revision was drafted (version B2, B3 and so on). This eliminated confusion as to which version of the data set was the latest and most complete. Final version B of the data was then forwarded to the T&B Systems Data Manager for processing into the CRPAQS Program format. Upon completion, the data was considered to be at Level 1.0.

<u>Level 1.0</u>
Once the data files were processed to Level 1 by the Data Manager, they were renamed version C, copied as version D (a working file), and then submitted for final review by the T&B Systems data validation technicians. When any other changes were deemed necessary, version D was renamed version D2, D3 and so on. The final iteration of this version was then submitted to the T&B Systems Data Manager who submitted it in turn to the CRPAQS Data Manager.

7.1.2 Rawinsonde Measurements

The rawinsonde data were initially processed in the field using both the manufacturer's (Sippican) and T&B Systems' software. The resulting data files contained data reduced to engineering units (pressure, temperature, humidity, wind speed and direction), computed parameters (height and dew point temperature), and data validation flag fields set by default as valid. This step in the process reflects Level 0.5 validation.

Post-field data processing and validation began with a comparison of ground truth with sonde surface reading, review of initial sonde readings to ensure the proper launch record was selected by processing programs, and quick review of set of sounding records to ensure the entire observation was processed. If required, the raw sounding data (Level 0) was reprocessed and checked again.

Level 1 screening included objective computerized screening for outlier temperature and wind gradients, and visual examination of the plotted data by personnel experienced with rawinsonde observations and the meteorology of the San Joaquin Valley. Outlier datum were flagged as "suspect" unless there was compelling evidence that the measurement was invalid. Data were not interpolated nor were external calibration factors applied. Therefore, the only flags used in the Level 1 database were missing, valid, suspect, or invalid.

7.2 Data Validation Flags

7.2.1 Nephelometer

The nephelometer database for the CRPAQS Satellite Network Program has been validated to Level 1.0, and submitted by T&B Systems to the CRPAQS Project Data Manager in the prescribed CRPAQS format.

The data submitted included pertinent information about each 5-minute averaged b_{sp} record, including the site identification code; the year, date and time when the data was recorded; codes describing the parameter and method of measurement; and primary and secondary validation flags that indicate the status of the specific 5-minute result.

T&B Systems data processing and quality control personnel, according to the flagging conventions established by the CRPAQS Data Manager, determined the data validation flags. Many of the flags used are generic to the CRPAQS database. Other flags are more specific to the nephelometer data. **Table 7-1** presents the flag codes and descriptions for the Primary and Secondary Flags used in the Annual and Winter data sets. **Table 7-2** shows the flagging conventions used for the Fall Saturation Network Program. The Fall Program conventions are less extensive because that database was validated and submitted to the CRPAQS Data Manager prior to the finalization of all of the program conventions.

Following are some comments of clarification concerning the b_{sp} data flags:

<u>M (Missing)</u>
No data appears in the “Results” column of the database listing, because no data was recorded in the field. The most frequent reason for missing data is equipment malfunction, or running out of data logger storage capacity before the operator could download the electronic data file.

<u>S (Suspect)</u>
Data appears in the “Results” column, but the value may not be usable for certain applications. The utility of such data is up to the discretion of the user. The most common reasons for suspect nephelometer data in the CRPAQS Satellite Program are related to relative humidity (RH). An extensive effort was made to preclude the measurement of b_{sp} in very moist (>75 percent RH) ambient sample

air. Heaters, intended to lower the RH of incoming sample air, occasionally malfunctioned, especially early in the program.

I (Invalid)

Data appears in the "Results" column, but the values are not valid for various reasons. The invalid flag has been attached to the data at the discretion of the data reviewer. The flag is intended to warn the user that the data should not be used in most applications. The most common use for an invalid flag is to indicate that a data point was the result of the measurement of a calibration standard instead of ambient air. Some problems early in the project occurred when the nephelometer fan was inoperative. The resultant data in such a case may appear correct, but the response time was probably not to specification due to a low flow rate of air through the sampling chamber.

V0 (Valid 0)

The data that appears in the "Results" column is good data, usable for all applications. A number of secondary flags may accompany this data, even though it is deemed valid. The purpose of such flags is to mark the data that was retrieved when the enclosure was being artificially heated or sampling stream heater was operating continuously (RHC flag). The former condition occurred when light bulbs were used in place of the inlet air heater systems. The RHC secondary flag also appears in conjunction with suspect data. A continuously operating heater causes the sample air to be very dry, which may compromise the b_{sp} measurement. Continuous heater operation during moderate and wet ambient conditions results in the desired affect of preventing high RH sample air from entering the sensor. In those cases, a RHC flag is used in conjunction with V0.

V1 (Valid1) The data appearing in the "Results" column is good data. This data is flagged because the field data logger clock time was incorrect, and the database times had to be adjusted accordingly.

Table 7-1. Nephelometer Data Flags - CRPAQS Annual and Winter Programs

Primary Flags		Secondary Flags	
Code	**Description**	**Code**	**Description**
M	Missing	INF	Instrument Failure/Equipment Problem
M	Missing	SAM	Sampler Malfunction
M	Missing	EDC	Exceeded Data Storage Capacity
M	Missing	SPI	Site Power Interruption
M	Missing	FOE	Field Operator Error
M	Missing	SIA	Site Inaccessable
S	Suspect	RHH	RH Sensor in Nephelometer > 75%
S	Suspect	TOR	Nephelometer Temperature Out of Range
S	Suspect	RHC	RH Heater on Continuously
S	Suspect	RHS	RH Sensor Suspect
S	Suspect	SFI	Shelter Fan Inoperative
I	Invalid	OSR	Off-Scale Reading
I	Invalid	CIC	Calibration/Instrument Check
I	Invalid	FQC	Failed QC
I	Invalid	NFI	Nephelometer Fan Inoperative
I	Invalid	SPI	Site Power Interruption
I	Invalid	CC5	Clock Changed by more than 5 minutes
V0	Valid 0	NIE	No Problems or Issues Encountered
V0	Valid 0	JIF	Jacket Installed/Fan Configuration Changed
V0	Valid 0	SHC	Nephelometer Shelter Heat on Continuously
V0	Valid 0	RHC	RH Heater on Continosuly
V1	Valid 1	CC5	Clock Changed by more than 5 minutes
V1	Valid 1	CC15	Clock Changed by more than 15 minutes

Table 7-2. Nephelometer Data Flags - CRPAQS Fall Saturation Program

Primary Flags		**Secondary Flags**	
Code	**Description**	**Code**	**Description**
M	Missing	INF	Instrument Failure/Equipment Problem
M	Missing	SAM	Sampler Malfunction
M	Missing	SPI	Site Power Interruption
S	Suspect	RHH	RH Sensor in Nephelometer > 75%
S	Suspect	TOR	Nephelometer Temperature Out of Range
I	Invalid	OSR	Off-Scale Reading
I	Invalid	CIC	Calibration/Instrument Check
I	Invalid	FQC	Failed QC
V0	Valid 0	NIE	No Problems or Issues Encountered
V1	Valid 1	CC5	Clock Changed by more than 5 minutes

7.2.2 Rawinsonde

Data validity is flagged in T&B Systems' format as one of four conditions in columns adjacent to each observable (i.e., pressure, temperature, relative humidity, wind direction and speed). A blank indicates valid data. Interpolated data is indicated by a "1". Data were interpolated when "wet-bulb" phenomena were encountered. Suspect data are flagged with a "2" in the QC field. Where data were suspected of being erroneous based on our experience but lacked compelling evidence of equipment malfunction, it was flagged as suspect with the measured value intact. Invalidated and missing data are flagged in the QC field with a "9", and data values are set to "-999".

8. REFERENCES

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APPENDIX A

SITE LOCATIONS

Table A-1. CRPAQS Site Addresses, Elevations, and Coordinates, January 2002

SITE	ADDRESS	ELEVATION (MSL, meters) +/- 1 meter or +/- 5 meters*	COORDINATES (north) +/- 2"	COORDINATES (west) +/- 2"
ACP-Angels Camp	6850 Studhorse Flat Road, Sonora	373*	N 38° 0’ 21”	W 120° 29’ 29”
ALT1-Altamont Pass	Flynn Road exit, I-580	350*	N 37° 43’ 3”	W 121° 39’ 37”
ANGI-Angiola	36078 4th Avenue, Corcoran	60	N 35° 56’ 53”	W 119° 32’ 16”
BAC-Bkf. CA Avenue	5558 CA Ave. #430 (STI) #460 (ARB), Bakersfield	119	N 35° 21’ 24”	W 119° 3’ 45”
BARS-Barstow	40083 Hinkley Road, Hinkley	648	N 34° 58’ 43”	W 117° 11’ 8”
BGS-Bkf. Golden State	1120 Golden State, Bakersfield	126	N 35° 23’ 9”	W 119° 0’ 42”
BODB-Bodega Bay	Bodega Marine Lab, 2099 Westside Road, Bodega Bay	17	N 38° 19’ 8”	W 123° 4’ 22”
BQUC-Bouquet Canyon	Oso Pumping Station, N of Lancaster Road at 300th St. West, Gorman	1004*	N 34° 48’ 18”	W 118° 43’ 13”
BRES-Bkf. Residential	7301 Remington Avenue, Bakersfield	117	N 35° 21’ 29”	W 119° 5’ 1”
BTI-Bethel Island	5551 Bethel Island Road, Bethel Island	2	N 38° 0’ 23”	W 121° 38’ 31”
CAJP-Cajon Pass	Across from 9850 Whitehaven Road, Hesperia	1277	N 34° 22’ 7”	W 117° 26’ 52”
CANT-Cantil	33387 Norton Road, Cantil	613	N 35° 18’ 25”	W 117° 58’ 10”
CARP-Carrizo Plain	Soda Springs Road, 0.5 mile south of California Valley	598	N 35° 18’ 51”	W 119° 59’ 45”
CHLV-China Lake	Baker Site	684	N 35° 46’ 27”	W 117° 46’ 35”
CLO-Clovis, North Villa	908 N. Villa, Clovis	108	N 36° 49’ 10”	W 119° 42’ 59”
COP-Corcoran, Patterson	1520 Patterson Ave., Corcoran	63	N 36° 6’ 8”	W 119° 33’ 57”
CRLD-Crows Landing	2600 Hills Ferry Road, Newman	22	N 37° 20’ 6”	W 120° 58’ 58”
DUB1-Dublin	10009 Dublin Canyon Road	250*	N 37° 41’ 42”	W 121° 58’ 8”
EDI-Edison	4101 Kimber Avenue, Bakersfield	118	N 35° 21’ 1”	W 118° 57’ 26”
EDW-Edwards	North end of Rawinsonde Road, Edwards AFB	724	N 34° 55’ 46”	W 117° 54’ 15”

Table A-1. CRPAQS Site Addresses, Elevations, and Coordinates, January 2002

SITE	ADDRESS	ELEVATION (MSL, meters) +/- 1 meter or +/- 5 meters*	COORDINATES (north) +/- 2"	COORDINATES (west) +/- 2"
FEDL-Feedlot	8555 S. Valentine, Fresno (near Raisin City)	76	N 36° 36’ 40”	W 119° 51’ 19”
FEL-Fellows	Across from 25883 Hwy 33, Fellows	359	N 35° 12’ 9”	W 119° 32’ 45”
FELF-Fellows Foothills	Texaco Pump Site 47-1, Fellows	512*	N 35° 10’ 14”	W 119° 33’ 25”
FREM-Fresno vehicle	Pole #16629, 2253 E. Shields Ave., Fresno	96	N 36° 46’ 48”	W 119° 47’ 0”
FRES-Fresno residential	Pole #16962, 3534 Virginia Lane, Fresno	97	N 36° 46’ 59”	W 119° 46’ 6”
FSD-Fresno Drummond	4706 E. Drummond, Fresno	91	N 36° 42’ 20”	W 119° 44’ 29”
FSF-Fresno 1st Street	3425 First Street, Fresno	97	N 36° 46’ 54”	W 119° 46’ 24”
HAN-Hanford Irwin Street	807 S. Irwin St., Hanford	76	N 36° 18’ 53”	W 119° 38’ 38”
HELM-Helm	Near Placer & Springfield	55	N 36° 35’ 26”	W 120° 10’ 38”
KCW-Kettleman City	Omaha Avenue 2 miles west of Hwy 41, Kettleman City	69	N 36° 5’ 41”	W 119° 56’ 51”
KRV-Trimmer	Trimmer Ranger Station, 34845 Maxon Road	509*	N 36° 54’ 8”	W 119° 18’ 21”
LVR1-Livermore, Rincon	793 Rincon Street, Livermore	138	N 37° 41’ 15”	W 121° 47’ 3”
M14-Modesto, 14th St.	814 14th Street, Modesto	28	N 37° 38’ 31”	W 120° 59’ 40”
MOP-Mojave, Poole St.	923 Poole Street, Mojave	832	N 35° 3’ 2”	W 118° 8’ 54”
MRM-Merced, Midtown	2334 M Street, Merced	53	N 37° 18’ 30”	W 120° 28’ 50”
OLD-Oildale, Manor	3311 Manor Street, Oildale	180	N 35° 26’ 17”	W 119° 1’ 1”
OLW-Olancha	Just to east of Hwy 395	1124	N 36° 16’ 4”	W 117° 59’ 34”
PAC1-Pacheco Pass	Upper Cottonwood Wildlife Area, west of Los Banos	452*	N 37° 4’ 24”	W 121° 13’ 18”
PIXL-Pixley Wildlife	Road 88, 1.5 miles north of Avenue 56, Alpaugh	69	N 35° 54’ 49”	W 119° 22’ 33”

Table A-1. CRPAQS Site Addresses, Elevations, and Coordinates, January 2002

SITE	ADDRESS	ELEVATION (MSL, meters) +/- 1 meter or +/- 5 meters*	COORDINATES (north) +/- 2"	COORDINATES (west) +/- 2"
PLEG-Pleasant Grove	7310 Pacific Avenue, Pleasant Grove	10	N 38° 45’ 58”	W 121° 31’ 9”
S13-Sacramento T St.	1309 T Street, Sacramento	6	N 38° 34’ 6”	W 121° 29’ 36”
SDP-Sac. Del Paso	2700 Maryal Drive, Sacramento	26	N 38° 36’ 49”	W 121° 22’ 5”
SELM-Selma Airport	7225 Huntsman Avenue, Selma	94	N 36° 34’ 58”	W 119° 39’ 37”
SFA-San Francisco, Ark.	10 Arkansas St., San Francisco	6	N 37° 45’ 57”	W 122° 23’ 56”
SJ4-San Jose 4th Street	120 N. 4th Street, San Jose	26	N 37° 20’ 23”	W 121° 53’ 19”
SLDC-Soledad Canyon	700 E. Avenue S, Palmdale	856	N 34° 33’ 25”	W 118° 7’ 4”
SNFH-Sierra Foothills	31955 Auberry Road, Auberry	589*	N 37° 3’ 45”	W 119° 29’ 46”
SOH-Stockton, Hazelton	1601 E. Hazelton, Stockton	8	N 37° 57’ 1”	W 121° 16’ 8”
SWC-SW Chowchilla	20513 Road 4, Chowchilla	43	N 37° 2’ 53”	W 120° 28’ 18”
TEH2-Tehachapi	Near 19805 Dovetail Court, Tehachapi	1229*	N 35° 10’ 4”	W 118° 28’ 55”
TEJ-Tejon Pass	5500 Digier Road, Lebec	946*	N 34° 53’ 13”	W 118° 54’ 51”
VCS-Visalia Church St.	310 Church Street, Visalia	102	N 36° 19’ 57”	W 119° 17’ 28”
WAG-Walnut Grove tower	KCRA-TV tower, Walnut Grove	3	N 38° 15’ 52”	W 121° 29’ 26”
WLKP-Walker Pass	30147 Hwy 178, Onyx	927*	N 35° 43’ 40”	W 118° 8’ 16”
YOSE-Yosemite	Turtleback Dome	1685*	N 37° 42’ 41”	W 119° 41’ 45”
FALL STUDY SITES (IN THE CORCORAN AREA)				
BELL-Bell Avenue	Pole #1077 on NW corner of Bell and Miller	62	N 36° 6’ 12”	W 119° 34’ 59”
CANL-Canal	6th Ave., 0.9 mile S of Kansas Ave., 2nd to last pole on E side	69	N 36° 11’ 53”	W 119° 33’ 52”

Table A-1. CRPAQS Site Addresses, Elevations, and Coordinates, January 2002

SITE	ADDRESS	ELEVATION (MSL, meters) +/- 1 meter or +/- 5 meters*	COORDINATES (north) +/- 2"	COORDINATES (west) +/- 2"
C05-Old C05	Pole with transformer on E side of RR tracks, just N of Sherman	64	N 36^{o} 5’ 42”	W 119^{o} 33’ 15”
COP-Corcoran Patterson	1520 Patterson Ave., SJVAPCD site	63	N 36^{o} 6’ 8”	W 119^{o} 33’ 57”
COPE-COP East	Pole #CTC1214113 in alley between Patterson and Cardosa, E of Hale	64	N 36^{o} 6’ 8”	W 119^{o} 33’ 52”
COPN-COP North	Cafeteria roof, John Muir School, 707 Letts Avenue	64	N 36^{o} 6’ 14”	W 119^{o} 34’ 2”
COPS-COP South	Roof of Goretti Center, Our Lady of Lourdes Church, 1404 Hanna Avenue	63	N 36^{o} 6’ 1”	W 119^{o} 33’ 56”
COPW-COP West	Roof of Corcoran School District offices, 1520 Patterson Avenue	63	N 36^{o} 6’ 7”	W 119^{o} 34’ 3”
COV1-Old Van Dorsten	Pole #CTC1039719, behind office on SE corner of Hanna and Van Dorsten	63	N 36^{o} 5’ 58”	W 119^{o} 33’ 47”
DAIP-Dairy Avenue Paved	Pole #GT209662, 2nd pole S of North Street on Dairy Avenue	63	N 36^{o} 6’ 18”	W 119^{o} 34’ 19”
DAIU-Dairy Avenue Unpaved	Pole #CTC1207297, SE corner of Dairy and Tennent	63	N 36^{o} 6’ 36”	W 119^{o} 34’ 20”
GRA-Grain Elevators	Set of 4 poles just S of Whitley and E of the RR tracks, 30 m W of pole #100	64	N 36^{o} 5’ 51”	W 119^{o} 33’ 19”
GRAE-GRA East	GTE/PG&E pole on Whitley E of Pickerell, first pole W of J's Market; phone pedestal #1539	65	N 36^{o} 5’ 53”	W 119^{o} 33’ 10”
GREN-GRA North	Pole #478, on SW corner of Flory and Hanna	64	N 36^{o} 5’ 59”	W 119^{o} 33’ 25”

Table A-1. CRPAQS Site Addresses, Elevations, and Coordinates, January 2002

SITE	ADDRESS	ELEVATION (MSL, meters) +/- 1 meter or +/- 5 meters*	COORDINATES (north) +/- 2"	COORDINATES (west) +/- 2"
GRAS-GRA South	Pole #534 on NW corner of Otis and Sherman	64	N 36° 5' 40"	W 119° 33' 17"
GRAW-GRA West	Pole #CTC1038876 on NW corner of Jepson and Flory	64	N 36° 5' 48"	W 119° 33' 26"
H43-Highway 43 South	Pole at intersection of Hwy 43 and Santa Fe Avenue/4th Avenue, in grassy triangle	64	N 36° 4' 18"	W 119° 32' 10"
HAN-Hanford	807 S. Irwin Street, SJVAPCD site	76	N 36° 18' 53"	W 119° 38' 38"
LATN-Laton	N side of Riverdale Road, 2nd pole E of Clovis Road, pole #1091DFP440	78	N 36° 26' 18"	W 119° 42' 25"
NIL-Niles Avenue	Pole #700 on NW corner of Niles and 6 1/4 Avenue	64	N 36° 6' 59"	W 119° 34' 36"
ORE-Oregon Avenue	Cafeteria roof, Mark Twain School, 1500 Oregon Avenue	62	N 36° 5' 15"	W 119° 33' 57"
OTT-Ottawa Avenue	Community Day School, SW corner of Ottawa and Van Dorsten	62	N 36° 4' 59"	W 119° 33' 49"
SFE-Santa Fe Avenue	Pole #T207157 on E side of Santa Fe Avenue, 1 mile N of Hwy 43 intersection	64	N 36° 5' 2"	W 119° 32' 45"
SHER-Sherman Avenue	Roof of temporary classrooms, Bret Harte School, 1500 Letts Avenue	62	N 36° 5' 41"	W 119° 34' 5"
SPE-Spear/Olympic Avenue	Pole #CTC1214217 on S side of Olympic, just W of Branum	62	N 36° 5' 46"	W 119° 35' 4"
YOD-Yoder Boulevard	Pole #CTC1039727 on E side of Yoder, just N of Patterson	64	N 36° 6' 6"	W 119° 33' 30"

1) All coordinates are referenced to the NAD83 map datum-
2) Coordinates are reported as read by a Garmin GPS device at the site (model GPSII); accuracy is limited to about +/- 2" (approximately +/- 50 meters)-
3) Elevations are relative to sea level and were determined from a topo map; accuracy is +/- 1 meter for valley and coastal sites, +/- 5 meters for mountain sites (shown with asterisk*)

APPENDIX B

STANDARD OPERATING PROCEDURES AND FIELD FORMS

1. AirMetrics MiniVol PM Sampler
2. Radiance Research Model M90J Nephelometer
3. Hydrocarbon Sampler
4. Nephelometer Data Validation Procedures
5. Rawinsonde SOP & Checklist
6. Site Field Forms

Appendix B: 1.

MINIVOL SOP
Revision #: 0
Date: 9/3/99

STANDARD OPERATING PROCEDURE (SOP) FOR THE AIRMETRICS MINIVOL PM SAMPLER

Technical & Business System

(Excerpted from MiniVOL Portable Sampler Operation Manual Airmetrics, Springfield, OR)

1.0 GENERAL DISCUSSION

1.1 Scope and Application

This procedure describes the operation of the **portable MiniVol PM** samplers for the collection of suspended particulate matter on filter substrates which are amenable to measurement of aerosol mass and various chemical analyses. The portable filter sampler allows air to be drawn through a size-selective inlet. Both PM_{10} and $PM_{2.5}$ size-selective inlets will be utilized in the CRPAQS Satellite Network. They can be programmed to begin and end sampling at predetermined times. The sampler can be operated by a rechargeable battery at locations where no commercial AC power is available.

1.2 Measurement Principle

The measurement of PM is performed by drawing in a known volume of ambient air through a particle size selective inlet allowing smaller particles to pass through and impact a pre-weighed filter. The filter is weighed again after exposure yielding the mass gained over the collection period. The volume of air is calculated knowing the sampler flow-rate and duration of the sampler operation.

For this project, the portable particulate sampler draws ambient air through a filter at a constant flow rate of 5 l/minute. Assurance of this flow rate is achieved by calibrating the sampler to account specifically for the seasonal average ambient temperature and atmospheric pressure at the site.

The samplers are equipped to operate from either AC and DC power sources. The mode of operation at a specific site is dependent upon the availability of commercial AC power. In the DC mode, the sampler is attached to a charged battery pack prior to field sampling, making the sampler siting independent of external power. Each sampler has two battery packs to allow for 'continuous' field sampling; while the sampler is operating on one battery (up to 24 sampling hours on a single charge), the other battery is charged using an AC power adaptor.

The sampler is equipped with an inlet containing an impactor unit with either a 2.5-µm or 10-µm particle cut-point and a flow control system capable of maintaining a constant flow rate within the design specifications of the inlet. The impactor is designed for a 50% collection efficiency for particles of aerodynamic diameter of 10 µm or less at a flow rate of 5 l/minute. The inlet tube conducts air to a twin cylinder diaphragm pump. From the pump, air is forced through a standard rotameter (0-10 l/minute) where it is exhausted to the atmosphere inside the sampler housing. An elapsed time meter is used to totalize the time the sampler is operated within the flow and voltage specification. The sampler is equipped with a circuit which will automatically turn the sampler off if the batteries fail to supply sufficient voltage to the pump to maintain sampler flow within specification. A similar circuit is used to shut down sampling if a minimum flow rate cannot be maintained at a preset specification (this minimum flow rate is set at 4.0 l/minute and it can be adjusted at the potentiometer directly to the right of the timer liquid crystal display (LCD). If this situation occurs, a "low-battery" or "low flow" indicator light remains lit until the circuit is reset, and action should be taken to service the sampler and/or battery pack.

The PM samples are collected on numbered filter packs in Nuclepore polycarbonate filter holders. For CRPAQS, the filters will come pre-mounted in filter packs with impactor and quick-disconnect fittings installed at the DRI lab. The DRI lab will also clean and grease the impactor after each use. Hence the filter change-out requires only a minimum amount of time on-site, and not subject inclement weather.
Each filter pack is double-stage-- loaded with a pre-weighed 47 mm diameter front-filter and back-filters.

Teflon and citrus acid impregnated cellulose filters are used in B- and g-type filter packs. Quartz and NaCl impregnated cellulose filters are used in C- and h-type filter packs. D-type filter packs utilize ? and ? filter membranes. B-, C-and D-type filter packs are to be used for $PM_{2.5}$ and f- and g- type filter packs for PM_{10}.

The flow rate is recorded by the field technician from the sampler rotameter at the beginning and end of each sampling period. The sample volume is calculated from the average of the beginning and ending flow rates and the sample duration. Additional features of the portable sampler include a programmable timer which can be set to run up to six on/off-cycles (i.e., 12 programming steps) within a 24-hour period or a 24-hour on/off-cycle beginning and ending on any day of the week for up to six days. The sampler may be suspended from a variety of structures (e.g., telephone, power, light poles) using the sampler's hanging bracket.

Figure 1 illustrates the portable PM sampler with hanging bracket.

1.3 Measurement Interferences

1.3.1 Passive Deposition: Passive deposition occurs when particles and gases deposit on filters prior to and after sampling. Field blanks are used to quantify this bias, which is usually less than 30 µg of mass per 47 mm diameter filter over a duration of a 24- to 48-hour passive period.

1.3.2 Particle Bounce off the Impactor Plate: Particles larger than the design cut point can become re-entrained in the air flow after bouncing off the impactor plate. This situation is prevented by cleaning and greasing the impactor plate after every 24-hour sample run.

1.3.3 Gaseous Absorption and Particle Volatilization: Nitric acid and organic gases may be absorbed by particles on the filter. Conversely, ammonium nitrate can dissociate and the particulate nitrate and ammonium can escape as nitric acid and ammonia gas. Filters are unloaded and refrigerated immediately after sampling to minimize long-term volatilization.

1.3.4 Filter Integrity and Contamination: Filter integrity is compromised by improper handling which causes pieces of the filter to be lost after the pre-exposure weighing. Filter contamination results from material other than sampled aerosol being deposited on the filter (e.g., fingerprints, dirt). Filter material losses and contamination are minimized by the placement and removal of filters to and from filter holders in controlled laboratory conditions. Gloved hands and forceps are used in this filter processing. Spare loaded filter holders are provided in the field to minimize the need for filter loading and unloading in the field. Each filter holder is separately sealed prior to and after sampling. Batches of filters are inspected and submitted to chemical analysis prior to use to assure that they meet minimal blank concentration levels when received from the manufacturer.

1.3.5 Particle Loss During Transport: Particles have been found to be dislodged from filters during transport of coarse (greater than 2.5 microns) particles which are heavily loaded on the filter. The low flow rate (5 l/minute) of the portable sampler minimizes overloading of filters for the specified (≤ 24 hour) sample duration. Samples are also stored under refrigeration and transported with minimal handling.

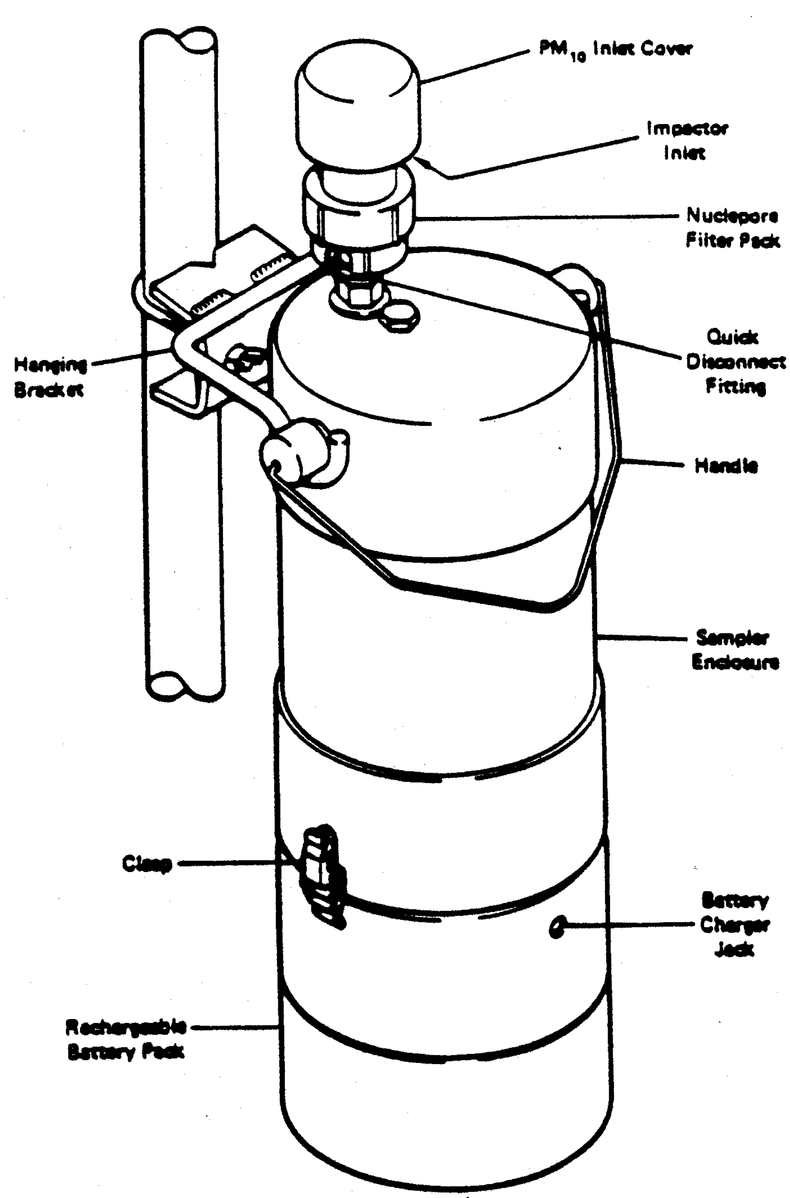

Figure 1. Diagram of the Portable MiniVol Sampler (Source: DRI)

1.3.6 Transmission Losses: Particles passing through a size-selective inlet could result in particle losses. Calculations show that diffusion and impaction losses are less than 1% for particles less than 10 microns in aerodynamic diameter.

1.4 Ranges and Typical Values

The range of concentrations measured by this method is limited by the sensitivity of the analytical instruments and the standard deviation of the values obtained by the dynamic blank. For 24-hour average mass concentrations, the range is approximately 6 to 300 $\mu g/m^3$.

1.5 Typical Lower Quantifiable Limits, Precision, and Accuracy

For mass concentrations, the typical lower quantifiable limit is approximately 3 to 6 $\mu g/m^3$ for the flow rates and 24-hour sample durations used in this project. The precision is calculated from replicate laboratory analysis and flow rate performance tests. This precision is between 6 and 9 μg/filter or between approximately 1 and 2 $\mu g/m^3$ for a 24-hour sampler representing a sample volume of 7.2 m^3. Accuracy is generally within the measurement precision.

1.6 Responsibilities

The site technician is responsible for carrying out this standard operating procedure and for the completion and submission of all documents.

The field operations supervisor is responsible for scheduling the site operator visits, identifying and correcting deficiencies, and coordinating sample transfer with the laboratory.

The laboratory supervisor, designated by DRI, is responsible for preparing samples, transmitting them to the field, receiving them from the field, reviewing documentation and sample integrity, and communicating deficiencies and remedial action to the field operations supervisor.

1.7 Definitions

PM – Airborne particulate matter

PM_{10} – Particulate matter that has an aerodynamic diameters of 10 microns or less

$PM_{2.5}$ – Particulate matter that has an aerodynamic diameters of 2.5 microns or less

The shipping boxes are insulated carrying cases which contain loaded filter holders with quick-disconnect fittings.

1.8 Health and Safety Warnings

Some PM samplers will be connected to 120 VAC line power. In those instances the site technician should be check closely for frayed wiring, and maintence should be performed when the sampler is dry.

2.0 APPARATUS AND MATERIALS – FIELD DATA COLLECTION

2.1 Airmetrics MiniVol Portable PM Filter Sampler:

The version of the portable PM sampler used in this project is shown schematically in **Figures 2 and 3.**

2.2 Sampler Accessories:

Hanging bracket and extension hook to lift sampler into the hanging cradle.

2.3 Nuclepore Filter Holders and Carrying Case:

Figure 4 illustrates the inlet and filter pack assembly. A double stage Nuclepore filter pack is used for this project. The Nuclepore extender section with glued anti-twist ring is used and a rubber gasket is placed on top of the extender section to prevent leaking under pressure. The filter holders are open faced and accommodate 47 mm diameter filters. The outlets have been bored to 3/8 inch diameter and fitted with hose barbs which allow connection to the quick disconnect fittings of the portable PM sampler. The anti-twist ring has been machined to prevent leakage. Rubber O-rings have been replaced with non-adsorbing viton O-rings to minimize transfer of O-ring contaminants to filter media.

Adhesive bar-coded ID labels are affixed to the filter holders when the filters are loaded. The first digit designates the network ID (i.e, S for Satellite), the second digit specifies the particle size (i.e., T for PM_{10}), and the fourth digit specifies filter substrate types (e.g., C for Teflon and citrus acid) The remaining four digits are the numerical ID numbers which are unique to each filter pack.

Each carrying case contains up to eight double-stage Nuclepore filter packs with a three-digit site code label affixed to the top and sides of the case. Each filter pack and the accompanying field data sheet is sealed in a separate ziplock bag with sampling site and date recorded on the field data sheet and marked on the ziplock bag.

2.4 Leak Testing Vacuum Gauge with Quick Disconnect Barb:

This gauge is inserted in the sampler to determine the vacuum which can be drawn. Less than 12 inches Hg vacuum indicates leaks in the system.

2.5 Documentation

Area site notebook with log sheets; portable computer system with bar code reader.

3.0 CALIBRATION STANDARDS

The transfer standard for portable PM_{10} sampler flow rates is a Gilibrator which has been calibrated against a Roots meter prior to the beginning of the sampling program. A calibrated external (independent) rotameter can also be used for performance flow testing on a monthly basis.

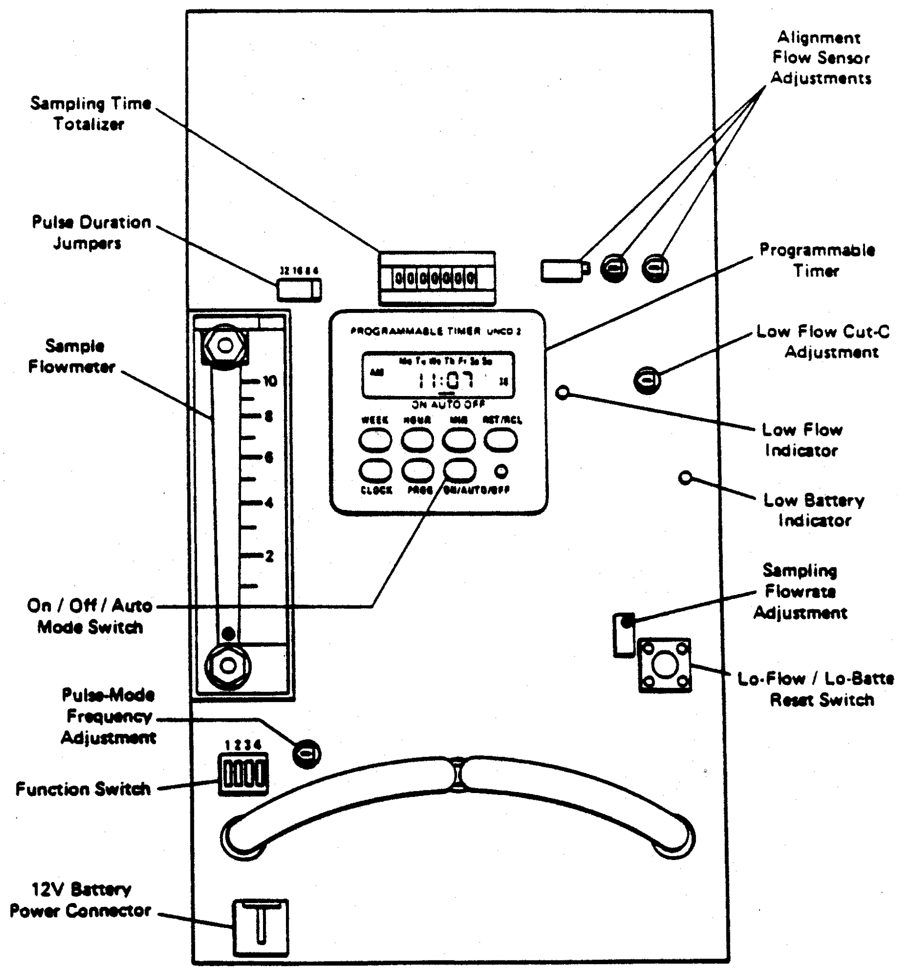

Figure 2. Front View of the Portable MiniVol Sampler (Source: DRI)

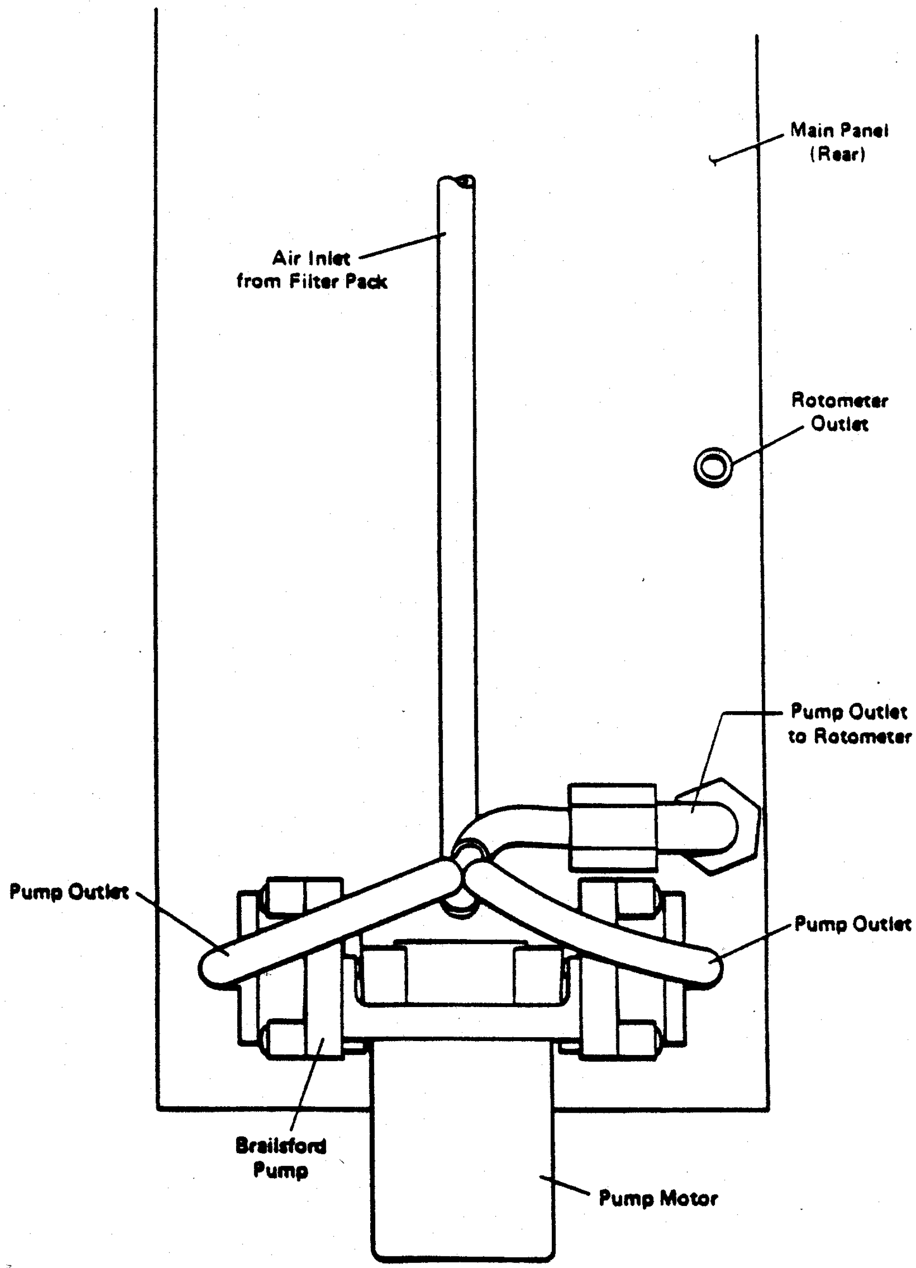

Figure 3. Back View of the Portable MiniVol Sampler (Source: DRI)

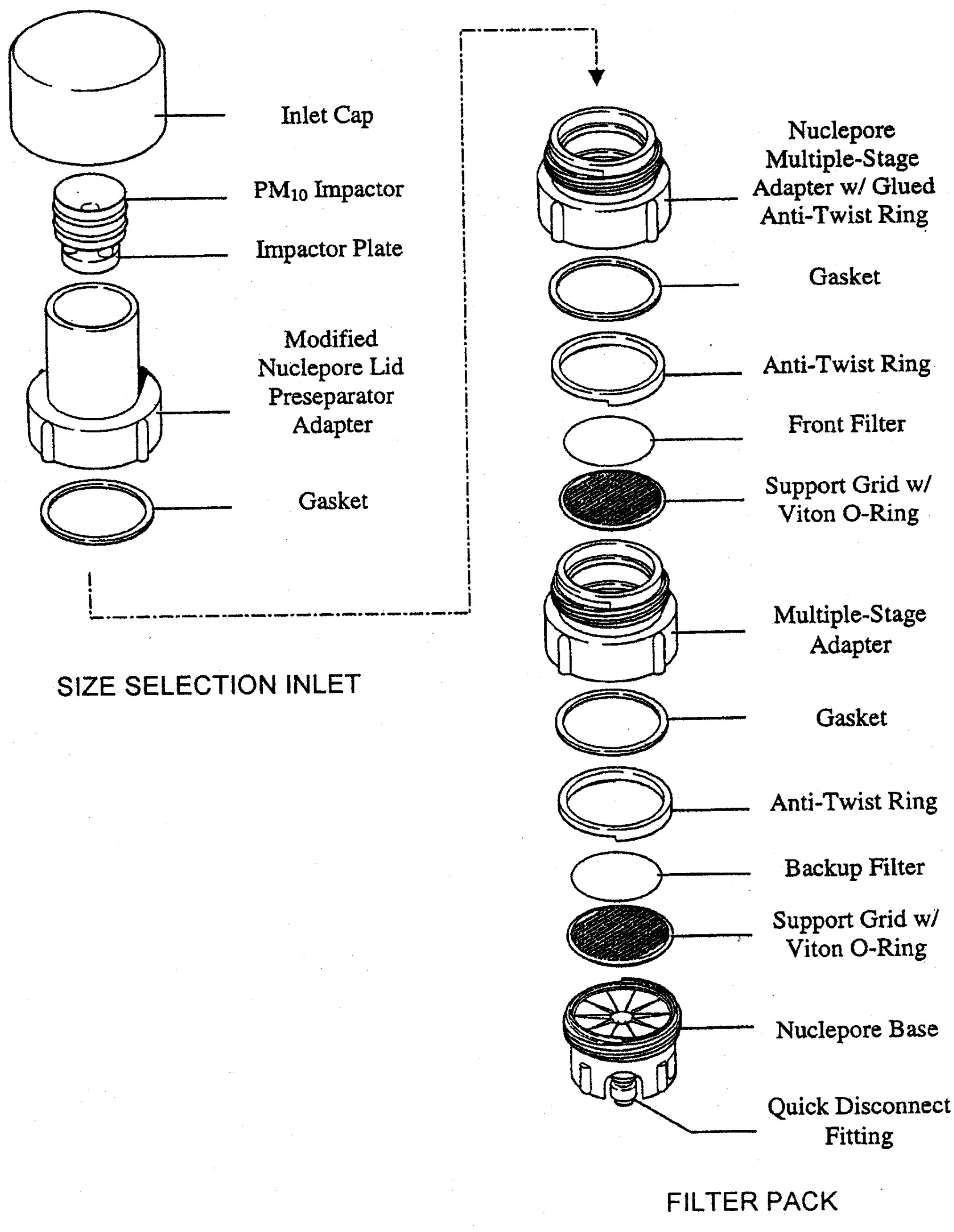

Figure 4. Schematic flow diagram of the DRI double-state filter pack assembly (Source: DRI)

4.0 SAMPLER OPERATION

Filter changing and flow rate checks are performed between each sampling period and require approximately 5 minutes per sampler.

4.1 Start Up

4.1.1 Preparation of Battery Pack:

4.1.1a Battery Pack Charging: Both sampler batteries are charged before the initial run. The batteries are charged for a minimum of 12 hours. After a 24-hour sample run, disconnect the used battery from the sampler and replace with the charged battery. Connect the charging plug of the AC/DC adaptor to the used battery and plug the adaptor into an AC receptacle. Disconnect AC/DC adaptor from battery pack after charging.

4.1.1b Battery Check: The voltage on each charged battery should be checked with a volt-ohm meter (VOM) or preferably, a test circuit with 3 12-volt flashlight bulbs in series prior to going to the field. Insert the VOM probe/test circuit into the odd color socket on the battery pack and in the socket closest to the battery recharger jack. The voltage reading should be 12 volts or higher. If the battery charge is less than 12 volts, take the battery apart using a Phillips screwdriver and look for loose connections. The fittings to the battery cover can become loose; they can be fixed by tightening the knots or inserting a starred compression washer into the connection. If the battery cannot be adequately charged, record the battery ID number and do not use the battery pack.

4.2 Routine Operations

4.2.1 Once the sampler rotameter has been calibrated (refer to Section 3) and a setpoint for an actual flow rate of 5 l/minute has been determined, the battery packs have been charged and a voltage of 12 volts has been obtained (at sites where applicable), and the sampler has been checked for leaks, the sampler may be used to collect air samples.

4.2.2 The sampler is positioned with the intake upward. It must be located in an unobstructed area at least 30 cm from any obstacle to air flow. The sampler hanging cradle may be attached to a power pole and the sampler hung on the cradle by lifting it using a telescoping pole with a hook on the end. The hanging cradle should be located at least 3 m off of the ground.

4.2.3 To Begin Sampling:

4.2.3a Inspect filters: Data sheets similar to **Figure 5** are contained in each ziplock bag along with the prelabeled unexposed filter pack. The sampling site and date for each filter pack is written on the ziplock bag. Upon receiving a set of filters from the laboratory, remove the cap of each filter pack, ensure filter ring and anti-twist ring are properly secured on top of the filter (Filter can be misaligned and filter ring can be loosened during shipping and handling). Be sure each filter pack in the shipping case is clean (no obvious foreign material on the filter). The data sheets should contain filter IDs for each site and sample date. Be sure the filter pack ID number matches the

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T&B Systems

Project: CPRAQS SATELLITE NETWORK Site (ID): Technician:

MiniVol Sampler ID: Nephelometer ID:

Nephelometer Notes:

Zero Check: Span Check: Zero Check:

File Name: Date Downloaded: Time Downloaded:

Servicing Done: ______

Visual Inspection of Equipment: ______

PM Sampler Notes:

Filter ID (affix label)	Sampling Date yymmdd	Sampling Period hhmm to hhmm		Elapsed time (hours)	Flow Rate (lpm)		Comments
					Initial	Final	

Figure 5. Example of the Field Data Sheet Prior to Sampling

Form 99-11v0

number on the field data sheet. If it is not the same, change the field data sheet. Replace filters which do not pass inspection with filters from the replacement box and change the ID on the data sheet accordingly.

4.2.3b Place sampler on a level, firm surface.

4.2.3c Prepare for Sampling. Unscrew either cap of handle (see Figure 1) and remove the handle. Lift pump and timer assembly board out by the 6" diameter cap and support the mounting board on the edge of the sampler casing, taking care not to pull connecting wires loose. ~~Hold by the top cap, not the board.~~

4.2.3d Procedures for Programming the Timer Clock.

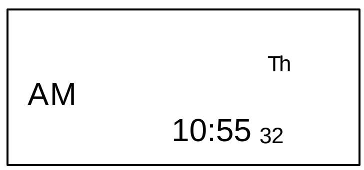
- Press and hold the "CLOCK" key (lower left hand corner of the Programmer Timer in Figure 2) for the next four steps:

  -- Press the "WEEK" key until the correct day of the week is displayed.

  -- Press the "HOUR" key until the correct hour of the day is displayed. Note that there are 12 am and 12 pm hours.

  -- Press the "MIN" key until the correct minute of the day is displayed.

  -- Verify the displayed clock time and release the "CLOCK" key. Example of the clock reading for Thursday at 10:55 am:



4.2.3e Programming Sampler ON and OFF Time.

(1) To start the first period of sampling (Programming Step 1 with "1^{ON}"):

- Timer display indicates "1^{on}" (lower left hand corner of the display) and begin programming start sampling day and time.

- Press the "WEEK" key to select the day of the week for sampling. There are 10 consecutive steps for this key.

  -- Steps 1 to 7: Sampling on any day of the week (display shows Mo, Tu, Ws, Th, or Fr as the "WEEK" key is pressed each time).

  -- Step 8: Sampling daily on weekdays with the same power on or off time (display shows all five days: Mo Tu Ws Th Fr).

  -- Step 9: Sampling on weekends with the same power on or off time (display shows: Sa Su)

  -- Step 10: Sampling on every day of the week with the same on or off time (display shows all 7 days of the week).

  -- If you missed the selection, you need to cycle through all 10 steps and start with step 1 again. Select "Fr" on step 5 to begin sampling on Friday.

- Press the "HOUR" key to select the start sampling hour.

  -- The "HOUR" key is incremented by one hour as the key is pressed from 1 to 12 AM and 1 to 12 PM.

  -- Select "AM 12" to start sampling at midnight for a 24-hour sampling schedule.

- Press the "MIN" key to select the start sampling minute.

  -- The "MIN" key is incremented by one minute as the key is pressed each time from minute :01 to :59.

  -- Select ":00" to start sampling at midnight.

- The display should read:

	Fr
AM	
1 ON	12:00

to start sampling at midnight (12:00 AM) on Friday.

(2) To stop first period of sampling:

- Press the "PROG" key and display shows "1OFF". Start to program end of sampling time.

- Repeat the steps above to select the day of the week and stop sampling time at 11:59 PM on Friday.

- The display should read:

AM	Fr
1^{OFF}	11:59

To stop sampling at midnight (11:59 PM) on the same day (i.e., Friday).

(3) Continue to program next sampling date and time of press "RST/RCL" (reset/recall) key to clear the LCD to read:

PM Mo Tu Ws Th Fr Sa Su	
3^{ON}	-- --

for the rest of the programming (steps 3^{ON} to 6^{OFF}).

(4) Push the "CLOCK" to resume the current time.

(5) Place the "ON/AUTO/OFF" key in the "AUTO" mode. A bar appears at the lower edge of the LCD.

4.2.3f At sites where required, install Charged Battery Pack in sampler: Place charged battery pack beside sampler. Unclamp two side clips at base of sampler. Lift sampler off used battery pack and place sampler on charged battery pack. Note: There are 3 pins on the bottom of the sampler. The pin that is closest to a side clip goes into the odd color (black) receptacle on the battery pack. Reclamp the two side clips. Press the "ON/AUTO/OFF" switch from "AUTO" to "ON" mode and pump will be turned on. Leave the pump running for one minute to ensure battery has adequate voltage to start the pump and pump is running properly. Press the "ON/AUTO/OFF" key to turn pump "OFF".

4.2.3g Install the Clean Impactor. Unmate the impactor section from the filter assembly and remove the rain cap (see Figure 4). Pushing with thumb from the bottom, remove the impactor through the top of the tube into palm of free hand. Inspect the O-rings on the impactor assembly for fitness and replace if necessary. Remove any extraneous material from the impactor assembly. Carefully re-insert the clean impactor assembly into the tube (from the top) until the top of the impactor is even with the top of the tube.

4.2.3h Install Unexposed Filter: The filter packs should be stored in an enclosure to avoid contaminating the filter. Holding filter pack level, carefully unscrew the filter pack cover (red plastic cover with Nuclepore extension section) and store the cover in the ziplock bag. Replace the filter pack cover with the threaded modified Nuclepore lid with impactor housing and inlet cap. Make sure there is an O-ring between the plastic anti-slip ring on the filter pack extender and the underside of the sampling inlet. Make sure the anti-slip ring fits firmly over the filter to prevent leakage (make sure the new filter ID corresponds to the ID on the data sheet for that site and date). Attach the filter pack and inlet assembly to the sampler using the quick disconnect push down on the sleeve of the receptacle, insert the barb of the filter holder, and pull up on the sleeve until it snaps into place. Record the sampler ID.

4.2.3i Check Beginning Flow Rate. Turn pump "ON" manually by switching "ON/AUTO/OFF" key to "ON". Attach quick disconnect plug to the inlet to perform

Check all filter holder joints. A setpoint for 5 l/minute will have been determined during calibration of each sampler. This setpoint will correspond to an actual flow rate of 5 l/minute. Adjust the pump speed with the "Sampling Flow Adjustment" key on the controller card (see Figure 2) using a small screwdriver, until the rotameter reads the setpoint value to the nearest 0.1 l/minute, taking the reading at the center of the ball. The sampler must warm up for at least one minute for the flow to stabilize. When the flow rate stabilizes at the set point, press "ON/AUTO/OFF" key to turn "OFF" and then "AUTO" to stop the pump. Enter the "Initial" flow rate and "Start" the elapsed time meter reading (located on the top of the programmable timer, see Figure 2) on the pre-assigned field data sheet. (The elapsed time meter is comprised of a six digit readout: the first four digits (in white) represent number in hours; the last two digits (in red) represent numbers in 0.1 and 0.01 of an hour.)

- Record the "End" elapsed time on the field data sheet (Figure 5) and calculate the total sampling time (ΔTime in **Figure 6**).

- Verify if total sampling hours is 24 ± 1 hour. If total sampling time exceeds the prespecified limits, verify the programming procedure and check the low battery and low flow rate indicator. Inform the field office for immediate service.

- Verify the "Programmable Timer" is in the "AUTO" mode.

4.2.3j Return the Pump and Timer Assembly to the Sampler Housing. Reassemble the handle. Use the extension hook to place sampler on mounting bracket. Position sampler on mounting bracket. Get underneath the sampler to hold it vertically to avoid breaking the inlet assembly and position the handle in the bracket holder.

REVISED

Project: CPRAQS SATELLITE NETWORK Site (ID): SNR Technician: DEL

MiniVol Sampler ID: EFEC-050 Nephelometer ID: S/N 00[illegible]11

Nephelometer Notes:

Zero Check: 000 Span Check: 023 Zero Check: 000

File Name: SNR1101 Date Downloaded: 11/1/99 Time Downloaded: 1405 PST

Servicing Done: ______

Visual Inspection of Equipment: OK

PM Sampler Notes:

Filter ID (affix label)	Sampling Date yymmdd	Sampling Period hhmm to hhmm		Elapsed time (hours)	Flow Rate ([illegible])		Comments
					Initial	Final	
	991030	0001	2359	24.0	5.1	5.1	

200026

Figure 6. Example of the Field Data Sheet After Sampling

T&B Systems

Form 99-11v0

4.2.4 **To Unload Exposed Filters.** Unloading of the exposed filters should be performed as soon as possibe at the end of the 24-hour sampling period.

4.2.4a Remove Sampler from Hanging Bracket. Using the extension hook, hold sampler vertically so as not to knock off the rain cap or damage the inlet.

4.2.4b Record the End Elapsed Time. Remove the handle assembly as described in Section 4.2.3c. Lift out pump and timer assembly, and record the final elapsed time on the field data sheet (Figure 6).

4.2.4c Record Final Flow Rate. Turn the pump "ON" by pressing the "ON/AUTO/OFF" key. Let the pump warm up for 1 minute to get a stable flow reading. Record the final flow rate indicated on the rotameter to the nearest 0.1 l/minute on the field data sheet (take the reading at center of the ball). Final flow rate should not vary more than 10% of the initial flow rate over a 24-hour sampling period.

4.2.4d Remove Exposed Filter Pack. Remove the exposed filter pack from the sampler using the quick-disconnect. Unscrew the inlet assembly from the filter pack. Screw the filter pack cap (red plastic cap with Nuclepore cap section) onto the exposed filter pack and store in the labelled ziplock bag with the completed field data sheet.

4.2.4e If required, remove discharged Battery Pack and install charged battery pack. Turn the pump on for one minute to warm up.

4.2.4f Remove Used Impactor and Install Clean Impactor.

4.2.4g See section 4.2.3 to start new set of sampling.

4.2.5 An 11-step checklist is shown below and is to be used at each site visit:

1. Verify that the exposed filter pack sampled correctly. Note if Low Battery or Low Flow light is "ON".
2. Record the "End" Elapsed Time and verify that it was sampled for 24 hours.
3. Turn pump "ON", record "Final Flow Rate on field data sheet, and turn the pump "OFF".
4. Place caps on exposed filter pack after removal from sampler.
5. Place exposed filter pack and completed field data sheet into the labelled ziplock bag.
6. Install charged battery pack and run the pump for at least one minute.
7. Remove used impactor and install clean impactor.
8. Install unexposed filter pack. Be sure that the sample ID corresponds to the appropriate sampling site and date on the field data sheet. Verify Programmable Timer Clock Time with current day and time. Verify program "ON/OFF" date and time.
9. Turn pump "ON", measure "Initial" Flow Rate, record on field data sheet, turn pump "OFF".
10. Record "Start" Elapsed Time on field data sheet.
11. Place "ON/AUTO/OFF" key in "AUTO" mode.

4.3 Shutdown

At the end of the monitoring program, perform last calibration. Record the condition of the sampler in the station logbook. Check all equipment and parts against the check-out sheet and assure that all are packed for shipment back to the Desert Research Institute in Reno, NV.

5.0 QUANTIFICATION

5.1 Calibration Procedures

5.1.1 Mark Rotameter Scales with Setpoint Readings: The actual flow rate through each rotameter is:

$$Q_{act} = (aQ_i+b)((760/P_2)(T_2/298))^{0.5}$$

where

Q_{act} = actual flow rate at temperature T_2 and pressure P_2 in liters per minute

Q_i = indicated rotameter reading in standard liters per minute

a = linear regression slope for relationship between rotameter reading and true flow rate at standard conditions

b = linear regression intercept for relationship between rotameter reading and true flow at standard conditions

The 5 l/minute setpoint is obtained from the above equation by substituting 5 for Q_{act} and solving for Q_i. The setpoint is located on a piece of tape applied to the rotameter scale for typical temperatures and pressures in the sampling area.

5.1.2 The pump is turned "ON" using "ON/AUTO/OFF" key. The flow rate is adjusted to the setpoint value with the "Flow Rate Adjustment" key (see Figure 2).

6.0 QUALITY CONTROL

6.1 Leak Checks

A leak check is performed every 30 days as described in Section 2.4.

6.2 Calibration Checks

The flow rate measurement is checked against a transfer standard prior to installation, at installation, after 6 months of operations, prior to the start of winter IOPs, and at the completion of the field program.

6.3 Sample Storage

Both unexposed and exposed filter media must be cold-stored. During travel to and from the sites, the filter packs will be kept in shipping containers cooled with Blue Ice. At the field offices, the samples will be kept in a refrigerator. Samples will be cold-conditioned during transit to the laboratory.

7.0 QUALITY AUDITING

Audits of flow rates are performed by an independent auditor with independent standards on a biannual basis.

8.0 DATA MANAGEMENT AND RECORDS KEEPING

8.1 Chain of Custody

An electronic chain-of-custody (COC) will be utilized that is keyed on the unique ID that will be assigned to each filter in the laboratory at DRI.

8.1.1 At each step in the handling of the filter packs, the filter pack status will be updated using the COC transaction program. Each transaction requires the following input fields:

- Filter ID
- Date (computer generated date) of entry
- Time (computer generataed time) of entry
- Transaction-see 8.1.2
- Location
- Sampling Date (if required)
- Volume Flow (if required)
- Tech
- Comments

8.1.2 Handling steps that require COC transaction:

- Filter pack assembled
- Filter pack shipped to field
- Filter pack received in field
- Filter pack installed on site
- Filter pack removed from site
- Filter pack shipped back to lab
- Filter pack received at lab
- Filter pack removed from service due to problems – should have associated comment field

8.2 Logs

As the monitoring sites will not have sheltered facilities, the site technicians will be required to carry a log book. The log book will include, at a minimum, notes of times/dates of arriving at the site, condition of the site and equipment, and notes of any servicing performed. Sample COC forms, that will accompany the filter packs, will be filled out in addition to the electronic COC and stored in the log book.

9.0 ACKNOWLEDGEMENT

This basis for this SOP was provided by DRI and modified by the Satellite team to be specific to this program.

Appendix B: 2.

Radiance Research Model M90J Nephelometer Field Calibration Check Procedures (SOP)

The procedures described below are for using the Air Resource Specialists, Inc. (ARS) Field Calibration System (FCS) to perform a field calibration check of the model M903 nephelometer.

Preparation

1.Open the FCS case, and move the rotameter support arm to the vertical position and insert the locking pin. Level the case and rotameter.
2. Plug the FCS into a 110 V AC electrical outlet. An extension cord is supplied with the FCS.
3. Attach the red hose provided to the pressure regulator stub and to a SUVA 134a calibration gas tank. **Do not turn the SUVA tank valve on at this time.**
4. Attach the yellow hose provided to the top of the rotameter and to the Radiance Research M903 Nephelometer.
S. Remove the sample fan from the lower outlet of the M903, and install the white PVC plug (no vent hole).

Zero Air Check

6. Turn the FCS ZERO/SPAN valve to the ZERO (up) position
7. Turn on the FCS switch to provide power to the air pump. Adjust the rotameter to obtain a center of ball reading of 60. Set the M903 display to the Main Screen (See M903 Manual) and record the time indicated on the Main Screen.
8. Allow zero air to flow through the instrument for at least 3-minutes prior to the beginning of an instrument 5-minute averaging period. The instrument writes averages every 5-minutes to its internal data logger, but does not display the value on the screen. Watch the Main Screen time until the beginning of a 5-minute increment is observed e.g. 00, 05, 10 etc. As the time changes to the beginning of a 5-minute increment, record the bs = value and time on the log sheet. As the main screen time reaches the next whole minute, record the bs = value and continue this process until 6 one-minute values are entered on the log sheet. The expected values should be close to 0.00 e^{-5}.
9. Record the nephelometer internal temperature and RH on the log sheet.
10. Record the ZERO, SPAN, WALL, and PMT values on the fog sheet. The ZERO value is in the lower right corner of the Zero Screen. The SPAN value is under the SPAN on the Span Screen. The WALL scatter is also on the Span Screen. The PMT value is above Vman on the Photomultiplier and Diagnostic Screen.
11. Turn off the FCS switch to turn off the air pump, and adjust the rotameter flow control knob to off (full clockwise)

SUVA Span Check

12. Install the second white plug containing a small vent hole into the top inlet of the M903. Leave the sample fan plug in place.
13. Rotate the SUVA pressure regulator control knob counter clockwise enough to ensure that no output pressure will be present when the SUVA valve is opened.
14. Turn the FCS ZERO/SPAN valve to the SPAN (down} position.
15. Slowly open the SUVA tank valve ¼ turn counter clockwise, and adjust the SUVA regulator control knob to obtain a reading of 4 psi on the regulator gauge (red scale).
16. Rotate the rotameter flow control knob slowly counter clockwise until a reading of 40 is obtained on the rotameter, and record the time indicated on the Main Screen.
17. Allow SUVA to flow through the instrument for at least 3-minutes prior to the beginning of an instrument 5-minute averaging period. The instrument writes averages every 5-minutes to its internal data logger, but does not display the value on the screen. Watch the Main Screen time until the beginning of a 5-minute increment is observed e.g. 00, 05, 10 etc. As the time changes to the beginning of a 5-minute increment, record the bs= value and time on the log sheet. As the main screen time reaches the next whole minute, record the bs= value and continue this process until 6 one-minute values are entered on the log sheet.
18. Record the nephelometer internal temperature and RH on the log sheet (note the RH value should be near zero)
19. After recording the 6th one-minute reading, switch to the Span Screen and compare the b_{scat} value (current reading} with the gas value (expected reading).

Note on the log sheet whether the zero and SUVA values are within acceptable limits as defined by the project specific protcols. If beyond limits, immediately notify the field manager. The field manager will determine whether an instrument calibration is required.

Restore the Nephelometer to the Monitoring Configuration

20. Rotate the rotameter flow control knob clockwise until it is closed and no flow is indicated on the rotameter.
21. Turn the SUVA valve clockwise until it is tightly closed.
22. Remove red SUVA hose from the FCS and SUVA tank, and install the hose plug.
23. Disconnect the yellow SUVA hose from the FCS and M903, and install hose plugs and caps. .
24. Remove the two calibration plugs from the M903, and re-install the sample fan.
25. Important: Make sure the nephelometer calibration hose is plugged.
26. Unplug the FCS.
27. Lower and secure rotameter support arm and stow all equipment in the FCS case.
28. Confirm Nephelometer operation. Check the plumbing connections to ensure that the sample flow is correct. Check that the time displayed on the Main Screen is advancing and that the bs= reading is reasonable for ambient conditions. Record the displayed time that the collection of valid data resumed.

Appendix B: 3. Hydrocarbon Sampler (Memo)

(Reproduced from fax)

From: Rei Rasmussen
TO: Don Lehrman
Date: Nov. 18, 1999

SUBJECT: SAMPLER SET-UP

1. CONNECT THE 2…115VAC PLUGS TO POWER AND THE BATTERY TERMINALS
2. ENTER THE PROGRAM INTO THE CHRONTROL®
3. REMOVER THE 2 BRASS SWAGELOK FITTINGS. THE ONE ON THE BULKHEAD FITTING ON ITS SIDE IS THE INLET AND THE HORIZONTAL “BLACK” SOLENOID-CUBE WITH FITTING OFF THE PUMP HEAD IS THE OUTLET.

4. ON THE CHRONTROL…1…ON, TURNS ON THE PUMP AND 2…ON, OPENS THE SOLENOID. AS ON THE PROGRAM SHEET…LOWER RIGHT TEST PROCEDURE.

THE FLOW IS AT 9 ML/MINUTE SO YOU WILL NEED TO ATTACH THE PURGE TEE 1/16-INCH LINE TO THE OUTLET AND THE BODY OF THE PURGE TEE TO THE FITTING ON AGL CAN.

LEAVE THE VALVE ON THE CAN CLOSED AND WATCH THE PRESSURE INCREASE, OPEN THE SIDE VALVE ON THE PURGE TEE TO VENT AND PURGE.

CLOSE THE PURGE TEE VALVE AND OPEN THE CAN VALVE AND LET SYSTEM OPERATE FOR 24 HRS…YOU SHOULD GET 18-19 PSIG FINAL PRESSURE.

ALSO ENCLOSED IS ~20-FT OF 1/16-ICH INLET LINE

CALL TO DISCUSS

REI RASMUSSEN

Appendix B.3 – Hydrocarbon Sampler

ChronTrol Program for Taking a 24 hour Integrated Sample Every 6th Day. 11/18/1999
Sampling starts on the day after setup)

Press		Display
Unlock Keyboard		
1.	103	000
Set Current Time (i.e. 10:00 am)		
1.	TIME	Blank
2.	1000am	1000
3.	ENTER	1000
Set 6 Day Week		
1.	WEEK	17
2.	6	16
3.	ENTER	Current Time
Set Day Omission		
1.	1	01
2.	DAY OMIT	00
3.	1	01
4.	3	05
5.	4	0d
6.	5	1d
7.	6	3d
8.	ENTER	Current Time
9.	2	02
10.	DAY OMIT	00
11	1	01
12.	3	05
13.	4	0d
14.	5	1d
15.	6	3d
16.	ENTER	Current Time

Press		Display
Enter Program		
1.	1	01
2.	CIRCUIT	00
3.	1	01
4.	ON	000
5.	1201 am	1201
6.	OFF	000
7.	1159 pm	1159.
8.	ENTER	Current Time
1.	2	02
2.	CIRCUIT	00
3.	2	02
4.	ON	000
5.	1201 am	1201
6.	OFF	000
7.	1159 pm	1159.
8.	ENTER	Current Time
Lock Keyboard		
1.	LOCK	Current Time

Manual Test to Check Pump & Solenoid:

Press 103 = Unlock Keyboard
Press Circuit 1 On = Pump Starts
Press Circuit 1 Off = Pump Stops
Press Circuit 2 On = Solenoid Opens (listen for click)
Press Circuit 2 Off = Solenoid Closes (listen for click)
Press LOCK Locks Keyboard

Appendix B.3 – Hydrocarbon Sampler

To program summa sampler on a day other than the day before deployment.

If programming for the first time, make sure all prior programs have been cleared. You must unplug and disconnect battery to clear all programs.

Follow standard ChronTrol Program for taking 24 hour integrated sample every 6th day.

To program earlier than the day before scheduled sampling day:

To fool the ChronTroler into thinking a day has passed:

Press **TIME**

type in: 11:59 p.m.

ENTER

Let control clock advance to 12:01 a.m.

Press **TIME**

Enter current time.

THIS WILL ADVANCE THE 6 DAY SCHEDULE ONE DAY FOR EACH TIME YOU TYPE IT IN. IF YOU WANT TO PROGRAM SAMPLER 2 DAYS BEFORE SAMPLING DAY, YOU MUST ENTER THE ABOVE PROCEDURE 5 TIMES. PROGRAM IS SET FOR SAMPLING ON DAY 2 OF A 6 DAY WEEK. CHECK IN WEEKLY CYCLE TO DETERMINE CURRENT DAY.

Check your programming by seeing what day of the week the sampler thinks it is.

Press **WEEK CYCLE**

IT SHOULD READ e.g. 6 6 (which indicates program thinks it is day 6 of a 6 day week). This would be correct if the current day is Thursday and you want the unit to go off on Saturday. Day 1 will be Friday, day 2 is Saturday (and Saturday is the deployment day for the next sample).

If not correct, enter appropriate advance day entries to get to the correct day.

If this is ok, PRESS TIME for current time display, lock control panel by pressing lock.

Appendix B.3 – Hydrocarbon Sampler

Provided by Rei Rasmusen: (503) 621-1435

TO CHECK FLOW 11/21/2000

Unlock Keyboard

Press		Display
1.	103	Current Time
2.	TIME	Blank
3.	TIME	Current Time

MAKE SURE ALL VALVES ARE CLOSED

Press		Display
1.	1	01
2.	ON	Current Time
3.	1	01
4.	OFF	Current Time
5.	2	02
6.	ON	Current Time
7.	2	02
8.	OFF	Current Time
9.	3	03
10.	ON	Current Time
11.	3	03
12.	OFF	Current Time
13.	4	04
14.	ON	Current Time
15.	4	04
16.	OFF	Current Time

CONNECT FLOWMETER TO TEFLON TUBE ON VALVE "1"

CHECK FLOW

1. Turn Pump ON by turning on Power Supply

Press		Display
1.	1	01
2.	ON	Current Time

Flow Should Read about 30. If it is significantly different:

Please call Bob Dalluge or Rei Rasmussen, for helpful hints:

Adjust the flow by removing the cap, the long silver nut on the right side of the flow controller, "1/2 wrench".

Adjust the allen screw using a "5/64 allen wrench". Clockwise decreases the flow, counterclockwise increases the flow.

Replace the cap on the flow controller.

3.	1	01
4.	OFF	Current Time

TO LOCK KEYBOARD

1.	LOCK	Current Time

Appendix B.3. Hydrocarbon Sampler (CRPAQS Winter Program)

Subject: Fw: SOP... sampler turn on for IOP
Date: Fri, 24 Nov 2000 10:08:47 -0800
From: "Don Lehrman" <donl@tbsys.com>
To: "Sue Hynek @TBS" <sue@tbsys.com>

WINTER intensive

Don Lehrman, CCM
Principal
T&B Systems
859 Second St.
Santa Rosa, CA 95404
(707)526-2775
(707)579-5954 (fax)

----- Original Message -----
From: Rei Rasmussen <rei@ese.ogi.edu>
To: <nicole@sonomatech.com>
Cc: <WSKDCK@AOL.Com>; <donl@sonic.net>; <sschelle@arb.ca.gov>; <earleww@AOL.Com>; <johnb@dri.edu>; <wanda@sonomatech.com>
Sent: Thursday, November 23, 2000 8:56 PM
Subject: SOP... sampler turn on for IOP

> *Dear Nicole:*
>
> *To start the VOC sampling for the CRPAQS IOP'S you will have visit the site on the day before the IOP...*
> *In your visit you will have to do the following:*
>
> *Arrive at the station after 10 AM....*
>
> *1. Start the pump.*
>
> *2. Open the valves on the canisters ...solenoid-circuit # 1 and #2.... these correspond to time 00-05AM and 05 to 10 AM*
>
> *3. Do not open the valves on the canisters at positions # 3 and # 4... until the next day... as these correspond to times 10 to 16 (4PM) and 16 to 00 (mid-night).*
>
> *4. On day one of the IOP you will have to arrive at the site before 10 AM to open the valves on canisters at positions #3 and #4 and the close the valve on canisters # 1 and # 2 (after 10 AM) and change out the used-exposed canisters for new canisters.*
>
> *At this time you can open the valve to these new canisters so your visit on day 2 of the IOP can be more flexible for changing out #3 , #4, and #1, etc.*
>
> *I hope this helps...*
>
> *PLEASE call to discuss...*
>
> *bests,*
>
> *rei rasmussen*

> *Prof. Rei Rasmussen*
> *rei @ese.ogi.edu*
> *Oregon Graduate Institute*
> *Dept Env Sci & Eng*
> *20000 NW Walker Rd*
> *Beaverton, Or 97006*
> *Morning Phone 503 621 1435*
> *Office: 503 690 1077*
> *Fax 503 690 1669*

DAY before IOP Arrive
AFTER 10 Am → Midnite
OPEN #1+2
DAY 1 - ARRIVE 9:30 - 9:45
Before 10:00
OPEN # 3+4
AFTER 10:00
Close #1 + 2 & change out,
OPEN VAlues on new CANS

Hydrocarbon Sampler Setup for CRPAQS Winter Program

Dr. Rei Rasmussen: rei@ese.ogi.edu, (503) 690-1087
Bob Dalluge: dalluge@ese.ogi.edu, (503) 690-1087

[redacted]

PROGRAM FOR 4 EVENT IOP 10/20/2000

ENTER PACIFIC **STANDARD** TIME

Press	Display
Unlock Keyboard	
1. 103	000
Set **PST** Time (i.e. 9:00 am)	
1. TIME	Blank
2. 900 am	900
3. ENTER	900

PACIFIC STANDARD TIME = 9:00 am

Press	Display
Enter Program	
1. 1	01
2. CIRCUIT	00
3. 1	01
4. ON	000
5. 1200 am	1200
6. OFF	000
7. 500 am	500
8. ENTER	Current Time
9. 2	02
10. CIRCUIT	00
11. 2	02
12. ON	000
13. 500 am	500
14. OFF	000
15. 1000 am	1000
16. ENTER	Current Time
17. 3	03
18. CIRCUIT	00
19. 3	03
20. ON	000
21. 1000 am	1000
22. OFF	000
23. 400 pm	400.
24. ENTER	Current Time
25. 4	04
26. CIRCUIT	00
27. 4	04
28. ON	000
29. 400 pm	400.
30. OFF	000
31. 1200 am	1200
32. ENTER	Current Time

LOCK KEYBOARD

Press	Display
1. LOCK	Current Time

Hydrocarbon Sampler Setup for CRPAQS Winter Program

Dr. Rei Rasmussen: rei@ese.ogi.edu, (503) 621-1435
Bob Dalluge: dalluge@ese.ogi.edu, (503) 690-1087

CHECK PROCEDURE FOR 4 EVENT SAMPLES 10/20/2000

To: UNLOCK KEYBOARD

Press	Display
1. 103	Current Time
2. TIME	Blank
3. TIME	Current Time

To: CHECK PROGRAM

Press	Display
1. 1	01
2. CIRCUIT	01
3. ON	1200
4. OFF	500
5. ENTER	Current Time
6. 2	02
7. CIRCUIT	02
8. ON	500
9. OFF	1000
10. ENTER	Current Time
11. 3	03
12. CIRCUIT	03
13. ON	1000
14. OFF	400.
15. ENTER	Current Time
16. 4	04
17. CIRCUIT	04
18. ON	400.
19. OFF	1200
20. ENTER	Current Time

TO: LOCK KEYBOARD

Press	Display
1. LOCK	Current Time

Appendix B: 4. Nephelometer Data Validation Procedures

Level 0.5 Processing :

Coordination of Field Notes, Paperwork & Data Collected

- All paperwork (site visit logs, data-download and calibration documentation) is checked for continuity and for pertinent information noted on-site that would have an impact upon the data. Pertinent information is marked at this time for flagging later in the actual data files.

Data Continuity Restored & Objective Screening Applied

- Any holes in the data continuity (when evident at this point) are next investigated, compared to downloaded data files, and when retrievable, this data is then merged into the master computer's files before being forwarded on to T&B's data manager for the objective screening and level 0.5 processing.

- Data files are returned to us objectively screened and flagged by our data manager. All of the Level 0 data will now have been processed into level 0.5 data form. This level 0.5 processing includes a computer screening to flag and invalidate bsp data outside of set range, RH > 75% or < 7% (excepting summertime desert sites), and temperature data considered to be out of range (lower than than 260 K / 8 F, higher than 325 K / 125 F). Lapses in data continuity are identified and the data flagged as missing. All bsp readings are converted from units of m^{-1} to units of Mm^{-1} . And Excel files are created along with time-series plots from the processed data. These files are now considered to be 0.5 level data files. These files are then marked as being version "A" (Example: incoming 0.5 December 2000 files for Pacheco Pass would now be marked as PAC1200A).

Level 1.0 Processing:

Creation of New Version, Detailed Validation & Flagging

- Duplicates of these 0.5 level files are created and identified as version "B". At this point the process of detailed validating begins and all field observation notes are applied to *this* version of the data set, version B. The data is now manually reviewed and flagged record-by-record in accordance with all pertinent information that might have an influence upon the data. The flags used are those previously agreed upon in a system of primary / secondary flags and codes that are assigned to particular situations that might be effecting the data (see below), and they are applied as appropriate. (When the agreed upon flags / codes are not sufficient to fit a specific case, as has happened on a few occasions, a new flag/code is posited, agreed upon, then added to the master list, and the new amended list is circulated). The final list of flagging codes:

Primary Flags		Secondary Flags	
Code	Description	Code	Description
M	Missing	INF	Instrument Failure/Equipment Problem
M	Missing	SAM	Sampler Malfunction
M	Missing	EDC	Exceeded Data Storage Capacity
M	Missing	SPI	Site Power Interruption
M	Missing	FOE	Field Operator Error
M	Missing	SIA	Site Inaccessable
S	Suspect	RHH	RH Sensor in Nephelometer > 75%
S	Suspect	TOR	Nephelometer Temperature Out of Range
S	Suspect	RHC	RH Heater on Continuously
S	Suspect	RHS	RH Sensor Suspect
S	Suspect	SFI	Shelter Fan Inoperative
I	Invalid	OSR	Off-Scale Reading
I	Invalid	CIC	Calibration/Instrument Check
I	Invalid	FQC	Failed QC
I	Invalid	NFI	Nephelometer Fan Inoperative
I	Invalid	SPI	Site Power Interruption
I	Invalid	CC5	Clock Changed by more than 5 minutes
V0	Valid 0	NIE	No Problems or Issues Encountered
V0	Valid 0	JIF	Jacket Installed/Fan Configuration Changed
V0	Valid 0	SHC	Nephelometer Shelter Heat on Continuously
V0	Valid 0	RHC	RH Heater on Continuously
V1	Valid 1	CC5	Clock Changed by more than 5 minutes
V1	Valid 1	CC15	Clock Changed by more than 15 minutes

- The manual review and validation will proceed on the assumption that all data is valid (primary flag V0), but with perhaps some mitigating circumstance that might have an impact (i.e. primary flag V1, with the secondary flag code CC5 when the clock was changed by more than 5 minutes, or primary flag V0 with the secondary flag SHC when data was being collected while the shelter heat on continuously). Based on the documented situational changes at the site, data may be set as missing, or suspect or invalid as a result, and the data itself should be flagged as such (M, S or I), with the secondary flags/codes used to qualify the M,S or I status. For example, if the shelter fan at a site is inoperative for a period, the data collected during this period will be labeled as Suspect (S) with the secondary flag of Nephelometer Fan Inoperative (NFI) applied to all observances of the data set (bsp, RH, temperature and pressure). In some situations however, such as a RH heater running continuously, only the bsp measurement will be labeled as Suspect, since only this specific observance might be effected by this particular circumstance. In some cases, additional notes may be relevant, and can be added to the record by adding an additional column to the far right of the data spreadsheet labeled "comments". For example, a field observation such as heavy construction taking place over a month's time in close proximity to a site, would be added to every record over that month with the additional comment "heavy construction reported near site." This additional information would thus be available to users of the data who might observe spikes in the data or other unusual behavior resulting from that activity.

Labeling Successive Versions as Detailed Validation Progresses

- If version B undergoes successive revisions at T&B before being forwarded on to the data manager, it will be renamed each time a new revision is drafted. Thus, there should be no confusion as to which version of the data set is the latest and most complete. PAC1200B, for example, should be assumed to be PAC1200B1, but successive in-house versions would be labeled as PAC1200B2, PAC1200B3, etc. Version B of the data, after the manual review, is then forwarded on to the data manager for the next phase of processing, which includes additional processing as required (e.g. correcting for clock errors). Once this next phase of processing is completed, the data should be considered to be at Level 1.0

- Once these files are further processed by the data manager, they are renamed as version C, copied as version D, and then thoroughly reviewed; it is to version D that we will make any final revisions as necessary. As above, each revision to the data set will be noted in-house as D2, D3 and so on. And so, as above, the final version of the data file sent on to our data manager will be the latest and most complete to date.

Documentation of Edits and Flags Applied & of Processing Milestones
All flags and comments applied to the data as validation progresses will be documented on the T&B Systems form "Surface Measurements QA Form." Thus, all validation and notes pertinent to the data can be reviewed at any time, and will also serve at a later time as a way to spot check the final data and assure that all notes were ultimately applied.

- All stages of this process as it proceeds will be documented on the T&B Systems form "CRPAQS Nephelometer Data Processing / Validation Milestones." This will enable anyone at anytime to look into the record and see exactly the status of each site's data as it progresses.

T&B Systems

CRPAQS NEPHELOMETER DATA PROCESSING/VALIDATION MILESTONES

SITE ID: CRLD (PAT)

			Comments
T&B transmits raw data to Liz (Level 0)	Ver..		
	Date		
	By		
Liz converts raw data runs obj. screening (Level 0.5)	Date	5/01	
Posts Level 0.5 to Master	Ver.	A	
	Date	~~[illegible]~~ 5/29/01	
	By	Liz	
T&B verifies obj. flags, adds flags/comments (Level 0.5)	Ver.	B	waiting 1/1/01 & 1/2/01 / rec'd 6/13/01
	Date	6/4/01	B2 finished 6/13.
	By	Derek	→ (B)
Transmitted to Liz (Level 1.0)	Ver.		
	Date		
	By		
Liz makes time corrections, adjusts as necessary (Level 1.0)	✔		
Level 1.0 posted to T&B Master	Ver.		
	Date		
	By		
Final review (Bill or Don)	Ver.		
	Date		
	By		
Level 1.05 Final Corrections <u>if any</u>	Ver.		
	Date		
	By		
Level 1.05 sent to client	Date		
	By		
Level 2 Calibration applied	Zero		
	Slope		

Nephelometer Data Processing / Validation Milestones Log

T&B Systems Inc

SURFACE MEASUREMENTS QA FORM

Date: June 01
Site ID: CRLD (PAT)
Reviewer: [illegible]

FROM Month/Day	FROM Julian Date	FROM Hour	TO Month/Day	TO Julian Date	TO Hour	Channel(s)	Flag	Reason
DATA BEGINS 8/9/00 — PREVIOUS DATA FILES DELETED								
8/9		12:05	8/9		13:05	all	I	CIC
8/17		7:50	8/17		8:30	all	I	CIC
8/17		7:55				all	I	CIC, CC5
8/25		12:20	8/25		13:15	all	I	CIC
8/25		12:25				all	I	CIC, CC5
9/5		10:55	9/5		11:40	all	I	CIC
9/5		11:00				all	I	CIC, CC5
9/5		11:45	9/6		4:55	all	M	EDC
9/18		6:50	9/18		7:10	all	I	CIC
9/18		6:55				all	I	CIC, CC5
9/30		9:45	9/30		10:00	all	I	CIC
9/30		9:50				all	I	CIC, CC5
10/5		15:10	10/5		15:20	comment: "neph 290 removed for fall study"		
10/5		15:25				comment: "instrument removed for fall study"		
11/29		8:45	11/29		8:55	comment: "neph 275 installed from fall study"		
11/29		9:00				DATA RESUMES.		
12/1		13:10	12/1		14:10	all	I	CIC

Nephelometer Internal Data Processing QC Log

Appendix B: 5.

Rawinsonde Standard Operating Procedures and Checklist

T&B Systems

859 Second St., Santa Rosa, CA 95404
(707 526-2775 Fax (707) 579-5954

June 2000

STANDARD OPERATING PROCEDURE

Performing Upper Air Soundings With the VIZ W-9000 Upper Air Data Acquisition System

Turn on the power strip to the VIZ W-9000 system (monitor, Zeemet rack, and computer). Turn on the site barometer so that it has time to stabilize. Verify that the computer clock time and date are correct, and reset if needed to correct the local time and date. (This is to be done by typing **Time hh:mm:ss <CR>**, and **Date mm-dd-yy <CR>**). At the DOS prompt begin the data acquisition software by typing **START <CR>**. The first data entry screen to appear will be the "Flight Identifier Initialization".

Carefully unpackage the Mark II microsonde. In the appropriate windows of the "Flight Identifier Initialization" screen, enter the sonde serial number (found on the side of the sonde) and the flight ascension identifier (mddhh) where m is the month #, dd is the date, and hh is the scheduled hour (military time, PDT) for launching the sounding; press **<ESC>** and accept the values when prompted.

Fill a 100-gram balloon to lift weight until neutral bouyancy is reached (the balloon will neither rise or sink), and afterwards tether the balloon. Attach the sonde to the balloon with the derailleur system.

Allow the system to lock onto the Loran stations while preparing the Mark II sonde as follows (also refer to the diagram on side of the sonde):

- straighten the transmitting antenna at the bottom of the sonde;
- position the thermistor element at a 45^o angle to the sonde;
- pull out 3 feet of the navaid antenna to assure that the derailleur is working properly;
- attach the sonde to the balloon and parachute;
- place the sonde outside away from metal objects, off the ground, etc..

Return to the computer and view the "Navaid Status, LORAN" screen (option 1). Look for an asterisk in the status column indicating that the station is locked on and verify that the Master, and at least two of the secondary stations are locked onto by the local Loran antenna. Verify that the signal-to-noise ratio (SNR) is greater than 50 for the Master Station and at least two secondary stations.

Record the station and sonde information on the Flight Log:

Under **Launch Information** record:

- Station Name, e.g. Santa Rosa, and Station I.D., e.g. SAN;
- Sounding Date (mm/dd/yy), e.g., 6/31/00;
- Flight Name (SSSmddhh), e.g. SAN630415 for a sounding released from Santa Rosa on June 30, and scheduled for release at 1500 PDT;
- Scheduled Launch Time (PDT), e.g. 1500 Local Time;
- Operator(s), e.g. Name and/or initials of any and all operators performing the sounding.

Under **Surface Information** record:

- Station Elevation (m-msl);
- Station Latitude (in degrees, tenths of degrees, and minutes);
- Station Longitude (in degrees, tenths of degrees, and minutes).

Check the sondes transmitting frequency. It should be 403 MHZ, (plus or minus 1 MHZ). Adjust the sonde frequency to 403 MHZ if necessary by turning the screw on the side of the sonde.

Check the sonde signal strength as displayed in the "Flight Preparation" menu. It should be greater than 200. If the signal strength is below 200 and the sonde has been on for at least 10 minutes, then turn the sonde off and repackage the sonde with a note to explain the problem. Begin with another sonde, entering the new sonde serial number under the option "Change Flight Identifiers" (option #7).

If the signal strength for the sonde is over 200, then remove the sonde humidity element cap and seal the flap. Under **Radiosonde Information** on the Flight Log enter the sonde serial number as read from the sonde label, the sonde frequency and signal strength as shown on the monitor.

Measure the surface data and record this on the Flight Log. If the station pressure is read from in inches of Hg, it must be converted to millibars by using the provided conversion table (DO NOT do your own calculations). Enter both values onto the Flight Log. Record the wind speed and wind direction from the provided equipment. Read the surface temperature and relative humidity from the measuring equipment provided. Record all these values on the Flight Log, along with your estimate of the cloud type and percent cloud cover, and any comments concerning the weather that may prove useful during data processing.

Record the temperature and relative humidity that the sonde is measuring as seen in the "Flight Preparation" menu on the Flight Log, checking that the difference between the sondes reading and the station equipment does not exceed reasonable limits (each site will have different limits based on the distance of the sonde from the sensing equipment). If the difference is outside the specified bounds, retrieve another sonde after deactivating this sonde (note on the sonde why it was rejected).

In the software, choose the "Surface Data" option (#2). In the "Surface Data" menu enter the following:

- Wind Speed in knots;
- Wind Direction;
- Station Pressure in mbs;
- Temperature;
- Relative humidity (as read from the sonde) NEVER USE A VALUE OF 0 FOR RELATIVE HUMIDITY!

Press **<ESC>**, accept the values when requested, returning to the "Flight Preparation" menu.

Enter option #3 ("Calibration"). Choose the second option and "Display/Modify Offsets". If the Running Averages Offset is greater than 0.5 mbs, but less than 5 mbs, press **P**, then **<CR>** and **<ESC>**, and accept these values when prompted. This will apply a correction to the sonde pressure readings, which can be seen in the "Flight Preparation" menu. On the Flight Log, enter the initial sonde pressure (before the offset is applied) and the pressure offset.

If the Running Averages Offset is greater than 5 mbs, label this sonde as faulty, and begin the process of using a different sonde.

After a visual check that an asterisk (*) is still present next to the "Navaid Status, Loran" option (i.e. the local antenna is still locked on), choose the "Arm for Launch" option (#5). The screen will change to reflect that the system is monitoring for launch. Once data appears in the PTU Data box (and this data appears reasonable), the sonde may be released.

Record on the Flight Log the time of launch that appears on the screen (after launch has been detected by the system). Enter the "Edit Launch" option (#7) and page and then move up line by line until reaching the top of the file. Record the first negative time value on the Flight Log. Continue to monitor the incoming data and note any questionable data in the Comments section of the Flight Log.

When the sounding has collected both PTU and wind data at least 50 mbs higher than the required pressure, end the flight by choosing the option to "End Flight" (#5). Verify that you do want to end the flight. Enter the "Data Analysis" option (#4), turn on the printer, toggle the printer on and choose the option to print the PTU and WIND summaries. Press **<ESC>** and return to the "Flight" menu. Choose option #6 ("Utilities"), then option #1 ("Save Flight Data To Disk").

Return to the "Flight" menu and exit the system.

At the DOS prompt, type **finish SSS mddhh**, to generate ASCII files and the combined data file in the standard format, and a plot file.

Copy <u>sssmddhh.dat</u> and <u>sssmddhh.zip</u> files to diskettes. Label and store the diskettes properly. Modem the data file c:\???\sssmddhh.dat to T&B Systems.

At this point record any comments you might have on this sounding. Make sure all problems encountered are mentioned, and note any unusual events or weather. Comments are very valuable during data processing and often explain curiosities within the data. Note why there may have been a delay in the launch time, the problems with each sonde that may have been attempted to use, reasons for early termination, etc..

Fill out header information on the Processing Log, label a file folder, and insert the printout of the data, the Flight Log, and the Processing Log into the folder and file.

When the sounding is complete, turn the power strip off to the system. Update the Site Log.

For soundings released on shipboard where default station settings can not be set prior to the field study, upon entering the "Flight Preparation" menu select "Utilities" (option #6), followed by the option for "Station Installation" (option #7). Press **<CR>** to skip

down the choices, and enter the correct latitude and longitude (in degrees, minutes, and seconds), and the station elevation in meters; press **<ESC>**, accept the values, and press **<ESC>** until reaching the "Flight Preparation" menu again.

VIZ 9000 MANAGERS CHECKSHEET

VIZ SETUP:

- make sure to enter in all the default values
- decide if you want msl or agl and enter station elevation in VIZ setup if you want msl

TRANSLATE:

- translate saves data only up to 500 mbs - change if necessary
- add the necessary site information (lat, long, & elev)
- add time zone and year
- add height unit (msl or agl)
- change subdirectory
- enter in the label for the job name

FINISH.BAT

- change subdirectory

COPYIT.BAT

- copies all of one flight into a subdirectory on a diskette

CHECK.SHT & VIZ.SOP

- change instructions for battery depending on type
- add in information regarding entering lat, long & elev if the site is located on a ship

VIZ 9000 EQUIPMENT

- hook the antenna in the Yagi connector and not the OMNI connection

VIZ SOFTWARE

- Edit MK2CTRL.DAT - to avoid getting negative pressures edit channel 1 (second line in the file) to not have value 43, and then reduce the first number (line one) by 1 (normally will be 26 after this editing)

- Edit SYSTEM.CON - the first letter should be an 'M' for processing wind data in meters.

- With regards to the "Edit Launch Mode". The record that VIZ chooses as the record marked with an "L" is the **first record in the air**. My software (Translate) goes to the record right before the record marked with the "L" and records this information as the surface data (or first record in the data listing). There should be very few if any flights that actually need the launch record changed within "Edit Launch Mode", so please don't do it unless the final data (.dat file) looks wrong. If the .dat file does look wrong (heights below zero or the station elevation) first check the journal file (.jnl) to see if you recorded the wrong elapsed time. This file will have the elapsed time without having to reenter the VIZ software. However the journal file units are minutes - and the log sheet and translate program require minutes.seconds - so remember to convert the units.

- If for some reason a sounding location is moved during the project there are changes that must be made to the software. Please let ne know so that I can walk you thru the changes involved with adding a site to the software. Or - as a last resort - leave the three letter site ID the same and note want date and time the new location went into effect - and I can correct the name back at the office. Never change the 3 letter ID and use the same software because all the flights will need reprocessing as the .dat file will have control characters (garbage in the header) that can only be corrected by hand editing which takes too much time.

- Right after the flight has been launched would be an excellent time to reread the surface data and enter in these new values if they are different from the first surface data reading entered. The VIZ software will incorporate this 'after the fact' data just fine. This will also alleviate editing of the data later. Surface wind readings should be monitored for at least one minute and the **prevailing** direction and **average** wind speed should be recorded.

VIZ 9000 MANAGERS CHECKSHEET

VIZ SETUP:

- make sure to enter in all the default values
- decide if you want msl or agl and enter station elevation in VIZ setup if you want msl

TRANSLATE:

- translate saves data only up to 500 mbs - change if necessary
- add the necessary site information (lat, long, & elev)
- add time zone and year
- add height unit (msl or agl)
- change subdirectory
- enter in the label for the job name

FINISH.BAT

- change subdirectory

COPYIT.BAT

- copies all of one flight into a subdirectory on a diskette

CHECK.SHT & VIZ.SOP

- change instructions for battery depending on type
- add in information regarding entering lat, long & elev if the site is located on a ship

VIZ 9000 EQUIPMENT

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- If for some reason a sounding location is moved during the project there are changes that must be made to the software. Please let ne know so that I can walk you thru the changes involved with adding a site to the software. Or - as a last resort - leave the three letter site ID the same and note want date and time the new location went into effect - and I can correct the name back at the office. Never change the 3 letter ID and use the same software because all the flights will need reprocessing as the .dat file will have control characters (garbage in the header) that can only be corrected by hand editing which takes too much time.

- Right after the flight has been launched would be an excellent time to reread the surface data and enter in these new values if they are different from the first surface data reading entered. The VIZ software will incorporate this 'after the fact' data just fine. This will also alleviate editing of the data later. Surface wind readings should be monitored for at least one minute and the **prevailing** direction and **average** wind speed should be recorded.

Appendix B: 6.

Site Visit Field Forms

ip T&B

Portable Survey Sampler FIELD DATA SHEET

Network Name: CRPAQS SATELLITE

Site Name: Bodega Marine Lab

site code BODG

Date shipped from DRI: JAN 0 6 2000 by: ____

Date shipped to DRI: 1-17-00 by: SH

Date received at DRI: ____ by: ____

Filter ID	Sampling Date (yymmdd)	Sampling Period[a]	Sampler ID	Elapsed Time (hour)		Δ Time (hour)	Flow Rate[b] (lpm)		Flags	Comments
				Start	End		Initial	Final		
BODGFTC009 sampler B green	000113	0000 to 2400	1125	865.29	889.25	23.96	6.0	6.0		
BODGFQN009 sampler C red	000113	0000 to 2400	1180	891.06	915.02	23.96	6.0	6.0		
sampler g purple		0000 to 2400								
sampler h yellow		0000 to 2400								
sampler D white		0000 to 2400								

[a] Sampling Period: Circle time zone: Pacific (PST PDT), Mountain (MST MDT), Central (CST CDT), Eastern (EST EDT)

[b] Flow Rate: Rotameter reading in liters per minute (lpm)

Example of DRI Chain of Custody MiniVol Data Sheet

T&B Systems

field form1v2MiniVol.doc

CRPAQS MiniVol Site Visit Checklist

(1) Site ID: Bodg **(2) Technician** SH

Key	Type of Check	Response	Unit 1	Unit 2	Unit 3	Unit 4
	Initial Site Service		Red	GREEN		
3	Date (calendar)	mm/dd/yy	2-15-00	2-15-00		
4	Time (watch)	PST	12:40	12:40		
5	Was site secure upon arrival?	yes/no	Y	Y		
	Initial MiniVol Service					
6	Sampler ID	Serial #	1180	1125		
7	Battery ID	Serial #	—	—		
8	Sampler time	PST	12:42	12:56		
9	Sampler Day of Week		Tues	Tues		
9	Power failure light on	yes/no	N	N		
10	Flow failure light on	yes/no	N	N		
11	Final flow rate	lpm	6.0	6.0		
12	Program day setting	Day of wk.	SAT	SAT		
	Hour meter reading (ending)	hours	1034.82	1009.05		
13	Hour meter reading (beginning)	hours	1010.86	985.09		
14	Accumulated time	hours	23.96	23.96		
15	Filter pack removed	DRI ID #	FQN014	FTC014		
16	DRI form completed	yes/no	Y	Y		
	Set-up Next Sampling Cycle					
17	Filter pack installed	DRI ID #	FQN015	FTC015		
18	Cleaned impacter(s) installed	yes/no	Y	Y		
19	Hat installed	yes/no	Y	Y		
20	Replace battery	yes/no/NA	—	—		
21	Clear out old program	yes/no	Y	Y		
22	Set program day	day of wk.	FRi	FRi		
23	Set start time	1201 AM	Y	Y		
24	Set end time	1159 PM	Y	Y		
25	Initial flow rate	lpm	6.0	6.0		
26	Hour meter reading (start)	hours	1034.82	1009.05		
27	Set mode to AUTO	yes/no	Y	Y		
	Power Check	yes/no	Y	Y		

Comments:

Example of MiniVol Site Visit Data Sheet

CRPAQS / Satellite Network
Nephelometer Site Visit Report

Site Data:

Site Code BOD6
Day Sun
Date 2/27/00
Time 15:14

Technician DL
Weather Conditions ⓒ, W/ ~25 kts

Nephelometer S/N 194
Heater S/N 02 Box S/N 8

Comments:

bs= 1.149 e-4 tc= 3.26 Mode 5 min
Nephelometer Date ____
Nephelometer Time 15:15:00
Time Zone PST
Actual Time 15:14:30
Time Change Necessary ? N

Adj. Nephelometer Date NA
Adj. Nephelometer Time ____
Time Zone ____

Data File (SSSMMDDY.NEP) BOD02270.NEP

Data Start Date 2/17/00 Time 13:15
Data Stop Date 2/27/00 Time 15:15

Included Time Days 10 Hours____ Minutes____

Comments:
unit down after dump while changing
shelter mount.

Reset Data Clock ✓ Marked ✓ bs= ✓

T&B Systems

FieldForm3v1NephSiteVst.doc

Example of Nephelometer Site Visit Report Form

CRPAQS / Satellite Network
Nephelometer Instrument Status Report

Site Code BODG
Date 2/27 Time 15:29 S/N 194

Main Screen #1 bs= 3.65 Date 2/27/06 Time 15:29 tc= 3.26e Mode 5 min	**T/P/Rh Set Screen #6** manual set Pabs: P= T= Rh=
Mode Change Screen #2	**Scat/P/T/Rh Set Screen #7** Air Rayleigh set Rsct: @ STP: 1.42e-5 14180 T= 287 Rh= 72 P= 1008
Zero Cal Screen #3 bscat= 3.82 set den= 9.45e-1 ZERO zden= 7.78e-1 zero= 1.14e-2 Offset 13992	**Cal Gas Screen #8** Cal gas / air Set Raleigh scat Rgas: Ratio= 7.35e0 00735
Span Cal Screen #4 bscat= 3.61 set gas= 8.74e-5 SPAN span= 9.06e1 Gain 53259 wall= 32%	**Serial Port Adj Screen #9** Serial Port Screen Raise-Lower sets Bps = 9600
Diagnostic Screen #5 scat 18000 698 span Vman	**Patent Screen #10**

FieldForm2v1NephInstStatus.doc

T&B Systems

Example of Nephelometer Instrument Status Report Form

CRPAQS / Satellite Network
Nephelometer Calibration Field Report

Site Data:

Site Code B006
Day 27 Friday
Date 3/3/00
Time 15:56

Technician DL
Weather Conditions CLR

Nephelometer S/N 194

Zero:

Time 15:58 (Door Opened)
Zero Air Set Flow 60

Purge Time 5 min

Time	Bs
16:10	.07 e-5
11	.09
12	.09
13	.09
14	.11
15	.10

P= 1011
T= 291
Rh= 71

Ave Bs Zero .09e-5

Record Times
16:10 - 16:15

Instrument Conditions:

Zero	13992	
Span	53259	
Wall	3296	
PMT V	698	
STP	1.42 e-5	
Rgas	7.35 ec	

nephcalibration-v1.doc

T&B Systems

Example of Nephelometer Zero and Span Check Forms (2 pgs)

Nephelometer Calibration Field Data Report - Page #2

Site Data:

Site Code BODG
Date 3/03/00

Span:

Time 16:15
Gas Pressure 4
Gas Flow 40

Purge Time 4 min

Time	Bs
1620	.8.19 e-5
1621	8.85e-5
22	8.96
23	8.89
24	8.59
25	9.00
26	9.02

P= 1011
T= 289
Rh= 05

[1] Avg Bs Span 8.89 -.09= 8.80
[2] Gas Value 8.72e-5

Ratio [1]/[2] 1.01 (should be between 0.8 to 1.2)

Record Times
16:20 - 16:25

Purge Time ______
Data Clock Reset ______
Bs= ______
tc= ______
Mode ______

fieldform5v2nephcalib.doc

T&B Systems

Example of Nephelometer Zero and Span Check Forms (2 pgs.)

FieldForm4v2Summa1-7-00.doc T&B Systems

CRPAQS Summa Canister Sampling - Site Visit Checksheet

Site: Brody Date: 12-4-00 Time: 11:26 LST
Technician: S St

1) Visually inspect the inlet line to ensure free from any obstruction. (Difficult to see this)

Exposed canister

2) Check recorded exposed canister ID 190
3) Record ChronTrol Time 11:25 Your Clock Time 11:26 LST
4) If ChronTrol time off by more than 15 minutes reset. Time reset —
5) Record exposed canister pressure reading 17 psig.
6) Close exposed canister valve ✓
7) Remove canister from the Purge Tee ✓
8) Replace Brass Cap on canister & tighten using 2 9/16" wrenches. DO NOT OVERTIGHTEN. Make fitting "snug".
9) Record the following on the manila canister tag: canister ID, site name, date canister installed on site 11-30-00, date canister exposed, 12/2 final pressure 17 psi. temperature in room, and technician initials.
10) Check to ensure pump and solenoid valve working. ✓ (See instructions) Circuits 1 and 2 indicator light on ChronTrol should be lit while this test is performing.

New canister

11) Remove end cap and attach new canister to Purge Tee.
Record canister ID 183
12) Open canister valve. Record pressure -30 Should be > = 26 inches Hg vacuum. If not, replace canister. Mark on tag "leaker" and set aside.
13) Check to ensure inlet and outlet lines not kinked, and that power supply light on ✓
14) Was site visited and checked during period sampler was operating? ____

* ALL FITTINGS NOT TO BE <u>OVERTIGHTENED</u>! Please call to discuss proper procedure.

Comments: Relocated Sampler - moved inlets
Don & Sue - All ok at site.

Example of Hydrocarbon Site Visit Check List

VOC SAMPLES / IOP EVENTS
HYDROCARBON MEASUREMENTS

RETURN CANISTERS TO: 2nd Winter IOP.

BRC / R.A. RASMUSSEN,
17010 NW SKYLINE BLVD
PORTLAND, OR 97231 **PH 503 621 1435**

LOCATION: Bodg

Sampler # ________

Start Pump ---Open Valves ---Record Data:

DATE/TIME	S1/CAN #	S2/CAN #	S3/CAN#	S4/CAN#
1ST Day TUES 12/26	~~NO CAN~~	~~NO CAN~~	030	C-69
2ND Day Wed 12/27	147	145	INSTALL 12/27 Wed before 10AM SSV149	S150
3RD Day Thur 12/28	INSTALL 12/27 AFTER 10AM SSV34	A106	INSTALL before 10AM 12/28 C-76	MXC18
NOT IOP DAY → 4TH Day FRI 12/29	INSTALL 12/28 after 10AM C110	125	INSTALL 12/29 before 10AM A-97	0-42

Signature Sue Hynek

At end of IOP: Shut Off Pump, Install New Cans-DO NOT OPEN THEIR VALVES, they are for the next IOP.

The Tags on Each Canister Need To Be Filled Out With: Location, Date/Time, and S# / Can #.

Recording the S# / Can # is Especially IMPORTANT as it Identifies the Sample Time-Interval per IOP Day. It MUST be Done on Both the Work Sheet and the Tags on the Individual Canisters

Example of Winter IOP Hydrocarbon Canister Installation & Retrieval Site Form

CRPAQS SATELLITE NEPHELOMETER SITE FORMS RECEIVED 2000

Site	Name	Serial #	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration	Site Visit	Status Rpt	Calibration
			Date			Date			Date			Date			Date			Date			Date		
ALT1	Altamont Pass	233	6/3	6/3					6/21	6/21		7/2	7/2		7/12	7/12		7/21	7/21	7/21	8/2	8/2	
BARS	Barstow														7/12	7/12	7/12				8/4	8/4	8/4
BODG	Bodega Marine Lab																				8/4	8/4	8/4
BQUC	Bouquet Cyn							Summer				7/12	7/12	7/12							8/4	8/4	8/4
BTI	Bethel Island	248	6/1	6/1		6/10	6/10		6/22	6/22		7/2	7/2		7/13	7/13		7/21	7/21	7/21	8/2	8/2	
CAJP	Cajon Pass																				8/4	8/4	8/4
CANT	Cantil								Summer			7/11	7/11	7/11							8/4	8/4	8/4
CARP	Carrizo Plain											7/7	7/7	7/7	7/19	7/19		8/1					
CHL	China Lake	237				6/15	6/15	6/15	6/28	6/28		7/3	7/3		7/18	7/18	7/18	7/31			8/9	8/9	
CLD	Crows Landing-Davis Rd																						
DUB1	Dublin	229	6/1	6/1		6/10	6/10		6/21	6/21		7/2	7/2		7/11	7/11		7/22	7/22			8/5	8/5
EDW	Edwards Air Force Base	235				6/15	6/15		6/28	6/28		7/10	7/10		7/18	7/18	7/18	7/31	7		8/9	8/9	
FEDL	Feedlot or Dairy	270				Installed→			6/22	6/22		7/6	7/6	7/6	7/16	7/16	7/16	7/25	7/25	7/25	8/14	8/14	8/14
FEL	Fellows	234				6/12	6/12					7/7	7/7	7/7	7/19	7/19		8/1					
FELF	Foothills above Fellows	249				6/12	6/12		6/27	6/27		7/7	7/7	7/7	7/19	7/19					8/8	8/8	
FREM	Fresno MV	211				6/14	6/14		6/28	6/28		7/9	7/9					7/20	7/20	7/20	8/2	8/2	
FRES	Residential FSF woodburning	230				6/14	6/14		6/28	6/28		7/9	7/9					7/20	7/20	7/20	8/2	8/2	8/2
KRV	Sierra Foothills-Kings River Vly	247				6/14	6/14		6/27	6/27		7/9	7/9					7/20	7/20	7/20	8/1	8/1	
OLW	Olancha	231	6/2			6/14	6/14					7/3	7/3		7/14	7/14	7/14	7/25			8/9	8/9	
PAC1	Pacheco Pass	214				6/15	6/15		6/28	6/28		7/9	7/9					7/21	7/21	7/21	8/2	8/2	
PIXL	Pixley Wildlife Refuge	210				6/13	6/13		6/27	6/27		7/8	7/8	7/8	7/19	7/19		8/1					
SDP	Sacramento Del Paso Manor	212													[illegible]	7/19							
SELM	Selma(S. Fresno gradient site)	263							6/27	6/27		7/9	7/9		7/16	7/16		7/25	7/25	7/25	8/2	8/2	8/2
SJ4	San Jose-4th Street	228				6/14	6/14											7/21	7/21	7/21			
SLDC	Soledad Cyn							Summer				7/12	7/12	7/12							8/4	8/4	8/4
SNFH	Sierra Nevada Foothills	227				6/14	6/14		6/27	6/27		7/9	7/9		[illegible]	[illegible]		7/20	7/20	7/20	8/1	8/1	8/1
TEH2	Tehachapi Pass	232	6/2	6/2	6/2	6/14	6/14		6/28	6/28		7/10	7/10		7/14	7/14	7/14	7/31	[illegible]		8/9	8/9	
TEJ	Tejon Pass	236				6/14	6/14					7/11	7/11	7/11							8/4	8/4	8/4
WAG	Walnut Grove-ground level																						
WLKP	Walker Pass								Summer			7/11	7/11	7/11							8/4	8/4	8/4

Example of Nephelometer Site Forms Received – CRPAQS Annual Satellite Network

1/4-7 IOP#3

#75

2/1-2/3 IOP #4

CRPAQS SATELLITE CHECKLIST FOR SITE FORMS RECEIVED - [redacted]

Site	Name	Type	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form	Check List	DRI Form
		Date →	[illegible]		1/4		1/5		1/6		1/7		[illegible]		2/1		2/2		2/3		BLANK							
ACP	Angels Camp	Kyle				✓		✓		✓		✓				✓		✓		✓		✓						
ALT	Altamont	Keifer				✓		✓		✓		✓				✓		✓		✓		✓						
BODG	Bodega Bay	Sue				✓		✓		✓						✓		✓		✓		✓						
BRES	Bakersfield Residential	Parsons				✓		✓		✓						✓		✓		✓		✓						
CLO	Clovis	Don				✓		✓		✓						✓		✓		✓		✓						
COP	Corcoran	Derek				✓		✓		✓						✓		✓		✓		✓						
ED1	Edison	Parsons				✓		✓		✓						✓		✓		✓		✓						
FEDL	Feedlot	Derek				✓		✓		✓						✓		✓		✓		✓						
FEL	Fellows	Parsons				✓		✓		✓						✓		✓		✓		✓						
FELF	Fellows Foothills	Parsons				✓		✓		✓						✓		✓		✓		✓						
FREM	Fresno Motorvehicle	Don				✓		✓		✓						✓		✓		✓		✓						
FRES	Residential Woodburn	Don				✓		✓		✓						✓		✓		✓		✓						
HELM	Helm Agri.	Derek				✓		✓		✓						✓		✓		✓		✓						
KCW	Kettleman City	Parsons				✓		✓		✓						✓		✓		✓		✓						
LVR1	Livermore	Keifer				✓		✓		✓						✓		✓		✓		✓						
M14	Modesto 14th St.	Knuth				✓		✓		✓						✓		✓		✓		✓						
MRM	Merced-Midtown	Knuth				✓		✓		✓						✓		✓		✓		✓						
OLW	Olancha	Chris				✓		✓		✓						✓		✓		✓		✓						
PIXL	Pixley	Parsons				✓		✓		✓						✓		✓		✓		✓						
S13	Sacramento T St.	Keifer				✓		✓		✓						✓		✓		✓		✓						
SELM	Selma (S. Fresno)	Derek				✓		✓		✓						✓		✓		✓		✓						
SOH	Stockton ~~Hazelton~~	Knuth				✓		✓		✓						✓		✓		✓		✓						
SWC	SW Chowchilla	Knuth				✓		✓		✓						✓		✓		✓		✓						
TEH	Tehachapi	Parsons				✓		✓		✓						✓		✓		✓		✓						
VCS	Visalia Church St.	Derek				✓		✓		✓						✓		✓		✓		✓						

Paperwork: ✓ = Installed \ = Removed complete paperwork = X Shaded area is the BLANK

Example of Checklist for Site Forms Received – CRPAQS Winter Satellite Network

APPENDIX C

MINIVOL FILTER RECOVERY TABLES

1. Instrument, Filter Type, Start-End Table
2. Annual
3. Fall
4. Winter

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
ACP	A,W	1321	b	12/02/1999	01/31/2001
	A,W	976	c	12/02/1999	01/31/2001
ALT1	A,W	1313	b	12/02/1999	01/31/2001
ANGI	A	1187	d	02/24/2000	01/31/2001
BAC	A	1278	d	02/06/2000	01/31/2001
BGS	A	1280	g	02/05/2000	02/03/2001
	A	1223	h	02/05/2000	02/03/2001
BODB	A,W	1125	b	12/02/1999	12/01/2000
	W	986	b	12/02/2000	01/31/2001
	A,W	1180	c	12/02/1999	01/31/2001
	W	996	c	12/26/2000	1 sample
	W	974	c	01/07/2001	1 sample
BRES	A,W	1099	b	12/20/1999	01/31/2001
	A,W	1219	c	12/20/1999	01/31/2001
BTI	A	973	b	12/02/1999	01/07/2001
	A	1109	c	12/02/1999	01/07/2001
	A	1150	d	02/12/2000	02/18/2000
	A	973	d	02/18/2000	02/24/2000
	A	1204	d	02/24/2000	01/31/2001
C05	F	1142	g	odd 10/9/00	11/14/2000
	F	1129	g	even 10/9/00	11/14/2000
CARP	A	1269	b	12/20/1999	01/31/2001
CHLV	A	1157	b	12/02/1999	01/31/2001
	A	1142	c	12/02/1999	08/10/2000
	A	1329	c	08/10/2000	01/31/2001
	A	1176	d	02/12/2000	04/06/2000
	A	1013	d	04/06/2000	04/18/2000
	A	1172	d	04/24/2000	08/30/2000
	A	595	d	09/03/2000	10/08/2000
	A	1154	d	10/15/2000	01/24/2001
CLO	A	1323	b	12/02/1999	12/06/1999
	A	1357	b	12/08/1999	12/12/1999
	A	1274	b	12/14/1999	09/15/2000
	A	592	b	09/27/2000	11/14/2000
	A,W	1215	b	11/20/2000	01/31/2001
	A,W	1344	c	12/02/1999	01/31/2001

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
COP	A	1318	b	12/08/1999	05/18/2000
	A,W	1332	b	05/24/2000	01/31/2001
	A,W	1170	g	12/29/1999	01/31/2001
	A,W	1011	h	12/29/1999	01/31/2001
COP	F	1149	g	odd 10/9/00	11/14/2000
	F	1272	g	even 10/9/00	11/14/2000
	F	996	h	odd 10/9/00	11/14/2000
	F	1001	h	even 10/9/00	11/14/2000
	F	1101	I	odd 10/9/00	11/14/2000
	F	1123	I	even 10/9/00	11/14/2000
DAIP	F	1196	g	odd 10/9/00	11/14/2000
	F	1132	g	even 10/9/00	11/14/2000
DAIU	F	1105	g	odd 10/9/00	11/14/2000
	F	1333	g	even 10/9/00	11/14/2000
EDI	A,W	1277	b	12/02/1999	01/31/2001
EDW	A	992	b	01/01/2000	01/31/2001
	A	1310	c	01/01/2000	06/17/2000
	A	977	c	06/23/2000	01/31/2001
	A	1311	d	02/12/2000	01/31/2001
FEDL	A,W	1218	b	06/23/2000	01/31/2001
	A	1126	c	06/23/2000	08/16/2001
	A,W	1106	c	08/22/2000	01/31/2001
	A,W	1100	d	06/23/2000	01/31/2001
FEL	A,W	1322	b	12/02/1999	01/31/2001
	A,W	1195	c	12/02/1999	01/31/2001
	A,W	1216	d	02/06/2000	01/31/2001
FELF	A,W	1153	b	12/14/1999	01/31/2001
	A,W	1012	c	12/14/1999	01/31/2001
FREM	A	1149	b	12/02/1999	12/08/1999
	A	987	b	12/08/1999	05/18/2000
	A,W	767	b	05/19/2000	01/31/2001
	A,W	1178	c	12/02/1999	01/31/2001
FRES	A,W	1199	b	12/02/1999	01/31/2001
	A,W	1177	c	12/02/1999	01/31/2001
	A,W	1271	d	02/06/2000	01/31/2001
FSD	A	970	g	12/05/1999	01/28/2001
	A	1275	h	12/05/1999	01/28/2001

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
FSF	A	1139	d	02/06/2000	08/04/2000
	A	1325	d	08/22/2000	01/31/2001
GRA	F	1192	g	odd 10/9/00	11/14/2000
	F	1004	g	even 10/9/00	11/14/2000
	F	1176	h	odd 10/9/00	11/14/2000
	F	1183	h	even 10/9/00	11/14/2000
	F	1151	i	odd 10/9/00	11/14/2000
	F	1310	i	even 10/9/00	11/14/2000
GRAS	F	1343	g	odd 10/9/00	10/11/2000
	F	1136	g	odd 10/12/00	11/14/2000
	F	1118	g	even 10/9/00	10/20/2000
	F	1175	g	even 10/22/00	11/14/2000
	F	1122	h	odd 10/9/00	11/14/2000
	F	1152	h	even 10/9/00	11/14/2000
	F	1018	i	odd 10/9/00	10/21/2000
	F	1127	i	odd 10/22/00	11/14/2000
	F	1006	i	even 10/9/00	10/21/2000
	F	1334	i	even 10/21/00	11/14/2000
H43	F	1139	g	odd 10/9/00	10/12/2000
	F	1116	g	odd 10/13/00	11/14/2000
	F	986	g	even 10/9/00	11/14/2000
	F	1182	h	odd 10/9/00	11/14/2000
	F	1213	h	even 10/9/00	11/14/2000
	F	1112	i	odd 10/9/00	11/14/2000
	F	1133	i	even 10/9/00	11/14/2000
HAN	A	1124	g	12/05/1999	01/28/2001
	A	969	h	12/05/1999	11/29/2000
	A	766	h	12/05/2000	01/28/2001
	F	974	g	odd 10/9/00	11/14/2000
	F	1126	g	even 10/9/00	10/19/2000
	F	975	g	even 10/20/00	11/14/2000
	F	1123	h	odd 10/9/00	11/14/2000
	F	1128	h	even 10/9/00	11/14/2000
	F	1111	i	odd 10/9/00	11/14/2000
	F	1214	i	even 10/9/00	11/14/2000
HELM	A,W	1000	b	12/02/1999	01/25/2001
	A	991	c	12/02/1999	12/14/1999

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
HELM	A	1014	c	12/21/1999	08/28/2000
	A,W	591	c	09/09/2000	01/01/2001
	A,W	1214	c	01/07/2001	01/31/2001
	A,W	995	d	02/06/2000	01/31/2001
KCW	A,W	1328	b	12/02/1999	01/31/2001
LVR1	A,W	1110	b	12/02/1999	01/31/2001
	A,W	1181	c	12/02/1999	01/31/2001
	A,W	1002	d	02/06/2000	01/31/2001
M14	A,W	1345	b	12/02/1999	01/31/2001
	A	1139	c	12/02/1999	01/25/2000
	A,W	1179	c	01/31/2000	01/31/2001
	A,W	1113	g	12/02/1999	01/31/2001
	A,W	1191	h	12/02/1999	01/28/2001
	A,W	1174	d	02/06/2000	01/31/2001
MOP	A	986	b	12/02/1999	04/06/2000
	A	1016	b	04/12/2000	01/31/2001
	A	1107	c	12/02/1999	07/11/2000
	A	1209	c	07/23/2000	01/31/2001
MRM	A,W	1217	b	12/02/1999	01/31/2001
	A	1106	c	12/02/1999	07/23/2000
	A,W	1005	c	07/23/2000	01/31/2001
OLD	A	1102	b*	12/02/1999	08/10/2000
	A	1154	c*	12/02/1999	08/10/2000
	A	1329	g*	12/02/1999	08/07/2000
	A	766	h*	12/02/1999	08/07/2000
	A	varies	see note	08/19/2000	11/02/2000
	A	1102	b	11/02/2000	01/31/2001
	A	1318	c	11/02/2000	01/31/2001
	A	1276	g	11/02/2000	01/31/2001
	A	1139	h	11/02/2000	01/31/2001
OLW	A,W	1117	b*	12/02/1999	01/31/2001
	A	1123	c*	12/02/1999	05/06/2000
	A	1190	c*	05/12/2000	11/08/2000
	A	1119	c*	11/14/2000	11/19/2000
	A,W	1118	c*	11/20/2000	01/31/2001
	A,W	972	d	02/06/2000	01/31/2001

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
ORE	F	985	g	odd 10/9/00	11/14/2000
	F	596	g	even 10/9/00	11/14/2000
PAC1	A	988	b	12/02/1999	12/26/2000
	A	1326	b	01/01/2001	01/31/2001
PIXL	A	1018	b	12/02/1999	12/14/1999
	A,W	1207	b	12/14/1999	01/31/2001
	A,W	1010	c	12/02/1999	01/31/2001
	A,W	1317	d	02/06/2000	01/31/2001
PLEG	A	1108	b	12/02/1999	01/31/2001
	A	1007	c	12/02/1999	01/31/2001
S13	A	1001	b	12/02/1999	04/10/2000
	A,W	1108	b	04/12/2000	01/31/2000
	A	1140	c	12/02/1999	06/10/2000
	A	1270	c	06/23/2000	01/31/2001
	A	971	d	02/06/2000	06/10/2000
	A,W	1270	d	06/10/2000	01/31/2001
SDP	A	1186	d	02/06/2000	01/31/2001
SELM	A,W	997	b	12/02/1999	01/31/2001
	A,W	1104	c	12/02/1999	01/31/2001
SFA	A	1135	b	12/02/1999	01/31/2001
	A	1221	c	12/02/1999	01/03/2001
SFE	F	1140	g	odd 10/9/00	11/14/2000
	F	1131	g	even 10/9/00	11/14/2000
	F	1008	h	odd 10/9/00	11/14/2000
	F	590	h	even 10/9/00	11/14/2000
	F	993	i	odd 10/9/00	11/14/2000
	F	1009	i	even 10/9/00	11/14/2000
SJ4	A	1315	d	02/06/2000	10/3/00?
SNFH	A	1171	b	12/02/1999	01/31/2001
	A	1270	c	12/02/1999	03/13/2000
	A	1205	c	03/19/2000	01/31/2001
	A	1324	d	02/06/2000	06/11/2000
	A	1017	d	06/17/2000	01/31/2001
SOH	A	1103	b	12/02/1999	11/20/2000
	A,W	1196	b	11/26/2000	01/31/2001
	A	1150	c	11/02/2000	11/20/2000
	A,W	1335	c	12/02/1999	01/31/2001

Table C-1. MiniVol Instrument, Filter Type, and Duration CRPAQS Annual Satellite Network

Site Code	Operated During	Serial #	Filter Type	Unit Start Date	Unit End Date
SWC	A,W	1314	b	12/02/1999	01/31/2001
	A	1259	c	12/02/1999	10/27/2000
	A,W	597	c	11/02/2000	01/31/2001
TEH2	A,W	1197	b	12/02/1999	01/31/2000
VCS	A,W	1336	b	12/02/1999	01/25/2001
	A,W	1330	c	12/02/1999	01/25/2001
	A,W	1130	g	12/02/1999	01/28/2001
	A,W	1206	h	12/02/1999	01/28/2001
YOD	F	1206	g	odd 10/9/00	11/14/2000
	F	1014	g	even 10/9/00	11/14/2000
YOSE	A	1320	d	02/12/2000	01/25/2001

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.1	Seq.2	Seq.3	Seq.4	Seq.5	Seq.7	Seq.8	Seq.9	Seq10	Seq11	Seq12	Seq13	Seq14	Seq15	Seq16	Seq17	Seq.18	Seq.19	Seq.20	Seq.21	Seq.22	Seq.23	Seq.24	Seq.25
ACP	Angels Camp	B		13																						
		C																								
ALT1	Altamont Pass	B																								
ANGI	Angiola	D																								
BAC	Bakersfield-Ca.St	D												12					14	2	2					
BGS	Bakersfield-Golden St	g		2	12																					
		h																								
BODG	Bodega Marine Lab	B																								
		C																								
BRES	BAC-Residental	B	1	1										14					2	2	2	2	14	12	2	2
		C	1	1										14					2	2	2	2	14		2	2
BTI	Bethel Island	B																								
		C																								
		D												21												
CARP	Carrizo Plain	B	1	1	1														2	2	2	2	6			
CHL	China Lake	B								2	2					3	3									
		C												14		3	3		6							
		D														3	3	8							6	
CLO	Clovis	B																								
		C		13																					13	
COP	Corcoran-Patterson	B																								
		C																								
		D																								7
		g		12	12																	17				
		h		12	12																	17				7
EDI	Edison	B							2	2										2	2	2				
EDW	Edwards AFB	B	1	1	1	1	1		2	2				2			2	2			7					2
		C	1	1	1	1	1		2	2				2	8		2	2								2
		D												2			2	2		17	17				17	2
FEDL	Feedlot or Dairy	B																								
		C																								
		D																								
FEL	Fellows	B	1																				7			
		C	1											12									14			
		D												12												
FELF	Foothills above Fellows	B																								
		C																	6							
FREM	Fresno MV	B	13	7		13			13																13	
		C	13		13	7			13																	
FRES	Residential woodburn	B																								
		C																								
		D																								
		D																								11
FSD	Fresno Drummond	g	13							13																
		h	13																							
FSF	Fresno-3425 First St	D																								
HAN	Hanford-Irwin St.	g		12	12																		17			
		h		12	12								11										17			
HELM	Agri/Helm-Cent. Fresno	B	7				31												31							
		C							13						31											
		D																								
KCW	Kettleman City	B										2		14					7	2	14					
LVR1	Livermore - New site	B																								

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.1	Seq.2	Seq.3	Seq.4	Seq.5	Seq.7	Seq.8	Seq.9	Seq10	Seq11	Seq12	Seq13	Seq14	Seq15	Seq16	Seq17	Seq.18	Seq.19	Seq.20	Seq.21	Seq.22	Seq.23	Seq.24	Seq.25
		C																								
		D																								
M14	Modesto 14th St.	B	7											11												
		C	7				11						31	11												
		D																								
		g																								
		h																					7			
MOP	Mojave-Poole	B																								
		C																								
MRM	Merced-midtown	B																								
		C																								
OLD	Oildale-Manor	B																	14							
		C																								
		g		12	12																					
		h	21	12	12																					
OLW	Olancha	B														2	2									
		C														2	2		6							
		D														2	2									
PAC1	Pacheco Pass	B		31																						
PIXL	Pixley Wildlife Refuge	B	7	7																						
		C																								
		D												12	8	7		7								
PLE	Pleasant Grove (N.Sac)	B																8								
		C																								
S13	Sacramento-1309 T St	B																				7			7	
		C																								
		D																								
SDP	Sac-Del PasoManor	D																								
SELM	Selma(S.Fresno gradient)	B		13																						
		C		13																						
SFA	SanFranciscoArkansas	B																								
		C																								
SJ4	San Jose-4th Street	D																								
SNFH	Sierra Nevada Foothills	B		12																		7				7
		C																		7						
		D																						7		
SOH	Stockton-Hazelton	B																								
		C																								
SWC	SW Chowchilla	B																			6					
		C																								
TEH2	Tehachapi Pass	B													12	12	3	3	2	2						2
VCS	Visalia Church St.	B																								
		C																								
		g		12						12	12												17			
		h		12						12	12												17			
YOSE1	YosemiteTurtleback	D																	7	7	7		7			
	Data Capture Rate:		82%	76%	88%	95%	95%	100%	93%	92%	97%	99%	98%	86%	96%	91%	89%	93%	88%	90%	90%	92%	89%	98%	93%	90%

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.26	Seq.27	Seq.28	Seq.29	Seq.30	Seq.31	Seq.32	Seq.33	Seq.34	Seq.35	Seq.36	Seq.37	Seq.39	Seq.40	Seq.41	Seq.42	Seq.43	Seq.44	Seq.45	Seq.46	Seq.47	Seq.48	Seq.50	Seq.51
ACP	Angels Camp	B																								
		C																								
ALT1	Altamont Pass	B																								
ANGI	Angiola	D											12											17	17	
BAC	Bakersfield-Ca.St	D													21									24	24	
BGS	Bakersfield-Golden St	g																								
		h														13										
BODG	Bodega Marine Lab	B																								
		C																								
BRES	BAC-Residental	B	2			6	13		2	2	2					2	2	2	2							
		C	2	12					2	2	2					2	2	2	2							
BTI	Bethel Island	B																								
		C																								
		D																								
CARP	Carrizo Plain	B																								
CHL	China Lake	B			2	2						14	14									10				
		C			2	2						14	14									10				
		D	6		2	2				13	13	14	14	14								10	7	6	6	6
CLO	Clovis	B																		6						
		C																								
COP	Corcoran-Patterson	B			16				14		13															
		C									13	13														
		D									13															
		g					6													12						
		h																								
EDI	Edison	B																								
EDW	Edwards AFB	B	2	2						12	14							2	2							
		C	2	2						12	14							2	2							
		D	2	2						12	14							2	2							
FEDL	Feedlot or Dairy	B																								
		C																								
		D																								
FEL	Fellows	B																								
		C																								
		D																								
FELF	Foothills above Fellows	B																								
		C																								
FREM	Fresno MV	B																								
		C																				6				
FRES	Residential woodburn	B			11																					
		C															7									
		D																								
		D											7													
FSD	Fresno Drummond	g																								
		h																								
FSF	Fresno-3425 First St	D																					6			
HAN	Hanford-Irwin St.	g																								16
		h															6									16
HELM	Agri/Helm-Cent. Fresno	B			11																					
		C			11																					
		D																						7	7	
KCW	Kettleman City	B																								
LVR1	Livermore - New site	B																								

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.26	Seq.27	Seq.28	Seq.29	Seq.30	Seq.31	Seq.32	Seq.33	Seq.34	Seq.35	Seq.36	Seq.37	Seq.39	Seq.40	Seq.41	Seq.42	Seq.43	Seq.44	Seq.45	Seq.46	Seq.47	Seq.48	Seq.50	Seq.51
		C																								
		D																								
M14	Modesto 14th St.	B																								
		C																								
		D																								
		g																								
		h																								
MOP	Mojave-Poole	B																								
		C																								
MRM	Merced-midtown	B																								
		C												14												
OLD	Oildale-Manor	B																								
		C																								
		g																					14			
		h																								
OLW	Olancha	B																								
		C					14																			
		D						12																		
PAC1	Pacheco Pass	B																								
PIXL	Pixley Wildlife Refuge	B																								
		C											21													
		D																								
PLE	Pleasant Grove (N.Sac)	B							19					12												
		C																								
S13	Sacramento-1309 T St	B							19																	
		C								6		7														
		D							19																	
SDP	Sac-Del PasoManor	D																								
SELM	Selma(S.Fresno gradient)	B																								
		C																								
SFA	SanFranciscoArkansas	B																								
		C																								
SJ4	San Jose-4th Street	D																								
SNFH	Sierra Nevada Foothills	B					15																			
		C																								
		D											6													
SOH	Stockton-Hazelton	B																								
		C																								13
SWC	SW Chowchilla	B																								
		C																								
TEH2	Tehachapi Pass	B	2	2																						
VCS	Visalia Church St.	B												8												
		C											8	8												
		g																								
		h											8													
YOSE1	YosemiteTurtleback	D																								
	Data Capture Rate:		93%	95%	93%	96%	96%	99%	94%	93%	91%	95%	91%	95%	99%	97%	96%	95%	95%	98%	100%	96%	97%	96%	96%	96%

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.52	Seq 53	Seq 54	Seq 55	Seq 56	Seq 57	Seq 58	Seq 59	Seq 61	Seq 62	Seq 63	Seq 64	Seq 65	Seq 66	Seq 67	Seq 68	Seq 69	Seq 70	Seq 72	Seq 73	Seq 74	Seq 75	Seq 76	Seq 77
ACP	Angels Camp	B																								
		C																								
ALT1	Altamont Pass	B																								
ANGI	Angiola	D																								
BAC	Bakersfield-Ca.St	D					12	14	14																	
BGS	Bakersfield-Golden St	g		12	14		12	14																		
		h		12	14		12	14																		
BODG	Bodega Marine Lab	B	12	14																7						
		C	12	14												10										
BRES	BAC-Residental	B					2																			
		C					2									6.14										
BTI	Bethel Island	B																		8						
		C																		12					12	
		D																								
CARP	Carrizo Plain	B																			6					
CHL	China Lake	B							2										7.13							
		C							2																	
		D		6			6		2									8.13								
CLO	Clovis	B			7	6								6	6	6										
		C																								
COP	Corcoran-Patterson	B																								
		C																								
		D																								
		g																								
		h																								
EDI	Edison	B		12	14					12									2							
EDW	Edwards AFB	B					2.12										6	7	7.13							
		C					2.12																			
		D					2.12																			
FEDL	Feedlot or Dairy	B																								
		C										31														
		D																								
FEL	Fellows	B																								
		C																								
		D																								
FELF	Foothills above Fellows	B												6.13												
		C		14								12														
FREM	Fresno MV	B															6									
		C																								
FRES	Residential woodburn	B	7	7																						
		C																								
		D																								
		D															12	6					13			
FSD	Fresno Drummond	g																								
		h																								
FSF	Fresno-3425 First St	D																								
HAN	Hanford-Irwin St.	g																								
		h															6									
HELM	Agri/Helm-Cent. Fresno	B												6												
		C																								
		D																								
KCW	Kettleman City	B																								
LVR1	Livermore - New site	B																								

Appendix C-2. MiniVol Filter Summary - CRPAQS Satellite Annual Network

Site	Name	Type	Seq.52	Seq 53	Seq 54	Seq 55	Seq 56	Seq 57	Seq 58	Seq 59	Seq 61	Seq 62	Seq 63	Seq 64	Seq 65	Seq 66	Seq 67	Seq 68	Seq 69	Seq 70	Seq 72	Seq 73	Seq 74	Seq 75	Seq 76	Seq 77
		C			12																					
		D																								
M14	Modesto 14th St.	B																								
		C																								
		D																								
		g																								
		h												6												
MOP	Mojave-Poole	B																	6.13	6.13						
		C																								
MRM	Merced-midtown	B																								
		C																								
OLD	Oildale-Manor	B			14			14	14	2																
		C			14			14	14	2																
		g	6		12	14		14																		
		h			12	14		14																		
OLW	Olancha	B				2		2	2										6.13							
		C		6		2		2	2					6.13	6.13											
		D		6		2		2	2																	
PAC1	Pacheco Pass	B				2																6				
PIXL	Pixley Wildlife Refuge	B																								
		C							13																	
		D							12								6.14	8								
PLE	Pleasant Grove (N.Sac)	B																	12							
		C																								
S13	Sacramento-1309 T St	B																								
		C																								
		D												10	10	7										
SDP	Sac-Del PasoManor	D																								
SELM	Selma(S.Fresno gradient)	B																								
		C																	6							
SFA	SanFranciscoArkansas	B																								
		C																								
SJ4	San Jose-4th Street	D																								
SNFH	Sierra Nevada Foothills	B																								
		C																								
		D																								
SOH	Stockton-Hazelton	B												7		6									21	
		C																								
SWC	SW Chowchilla	B												14												
		C																								
TEH2	Tehachapi Pass	B																								
VCS	Visalia Church St.	B																								
		C																								
		g																								
		h																								
YOSE1	YosemiteTurtleback	D																								
	Data Capture Rate:		96%	90%	91%	93%	91%	90%	89%	97%	100%	98%	100%	92%	97%	95%	95%	96%	93%	96%	99%	99%	99%	100%	98%	100%

Table C-2. Key for MiniVol Filter Summary – CRPAQS Satellite Annual Network

Group A – Site Access

01 Site Construction Incomplete
02 Site Access Restricted
03 Weather Related Access Problems

Group B – Mechanical Problems

06 Sampler Malfunction
07 Battery Malfunction
08 Other Electrical Problems
09 Sampler or Site Vandalism
10 Weather Related Mechanical Problems

Group C – Operator Error

11 Wrong Day
12 Wrong Times – Over Sample
13 Wrong Times – Under Sample
14 Sampler Not Activated
15 Sample Contaminated
16 Impactor Loading Problems
17 Data Lost

Group D – Laboratory Problems

21 Sampler Broken on Arrival
22 Incorrect Filters Shipped
23 Incorrect Impactors Shipped
24 Shipment Problems

Group E - Sampling Problems

31 Partial Sample Due to Overload
32 Weather Related Contamination
33 Safety Issues

Group F – Notes – Operation OK

51 Impactor Reused (with 23)
52 Changed or alternate filter number (with any of D above)
53 Sampler Changed
54
55 No Sample Required

Appendix C-3. MiniVol Data Capture by Site, Filter, and Day – CRPAQS Fall 2000

Site	Type	October																							November														Capture By Site & Type %
		9	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	
CO5	g										3		7										1																**92**
COP	g				4*																		1																**97**
	h																						1																**97**
	i	11											3										1				2			3									**86**
DAIP	g											8											1																**95**
DAIU	g										8																												**97**
GRA	g																						1																**97**
	h																																						**100**
	i																									4													**97**
GRAS	g	4*		3					6	4	6		6		6								1				2	5											**76**
	h																						1																**97**
	i	4		3					4		4		9B										1				2								2		2		**78**
H43	g	4		4	4	4																	1																**86**
	h				4																		1								4*								**95**
	i				4	4																	1				2B												**92**
HAN	g				4*		3		8		3																												**92**
	h								4																														**97**
	i	9																									2	5	5	5									**86**
ORE	g			10																																			**97**
SFE	g																			4			1					8											**92**
	h																			3			1			3					4							3	**86**
	i																						1																**97**
YOD	g																																						**100**
Capture by Day %		**83**	**100**	**83**	**88**	**92**	**96**	**100**	**83**	**96**	**79**	**96**	**88**	**100**	**96**	**100**	**100**	**100**	**100**	**92**	**100**	**100**	**38**	**100**	**100**	**92**	**83**	**88**	**96**	**92**	**96**	**100**	**100**	**100**	**96**	**100**	**96**	**96**	**93**

Code	Description	Code	Description	Code	Description
1	heavy rains no sample taken	5	sampler malfunction electrical	10	filter broken invalid sample
2	flow shutoff (possibly due to fog/rain)	6	sampler stolen missing	11	operator error oversample
3	sampler malfunction no sample	7	operator error undersample	B	Bugs filled inside of filter & instrument
4	battery malfunction undersample	8	sampler not activated	*	sample may be analyzable
4x	battery malfunction no sample	9	sampler shutoff (full of bugs)		

Table C-4. MiniVol Filter Summary - CRPAQS Satellite WINTER Network

(The 15 Winter IOP filters are highlighted and percentage is based only on these filters.)

	WINTER DATE (IOP)		02-Dec	08-Dec	14-Dec	15-Dec	16-Dec	17-Dec	18-Dec	20-Dec	25-Dec	26-Dec	27-Dec	28-Dec	01-Jan	04-Jan	05-Jan	06-Jan	07-Jan	13-Jan	19-Jan	25-Jan	31-Jan	01-Feb	02-Feb	03-Feb	
Site	Name	Type	Seq 68	Seq 69	Seq 70	cz	cz	cz	cz	Seq 72	some	Seq 73	cz	cz	Seq 74	cz	cz	cz	Seq 75	Seq 76	Seq 77	Seq 78	Seq.79	cz	cz	cz	Data
ACP	Angels Camp	B																									100%
		C																									100%
ALT1	Altamont Pass	B																									100%
ANGI	Angiola	D																									100%
BAC	Bakersfield-Ca.St	D																									100%
BGS	Bakersfield-Golden St	g																			6					100%
		h																									100%
BODG	Bodega Marine Lab	B			7																						100%
		C																									100%
BRES	BAC-Residental	B																									100%
		C																									100%
BTI	Bethel Island	B			8																						100%
		C			12															12			8				93%
		D																									100%
CARP	Carrizo Plain	B								6																	100%
CHL	China Lake	B		7.13																							100%
		C																									100%
		D	8.13																								100%
CLO	Clovis	B																									100%
		C																									100%
COP	Corcoran-Patterson	B																									100%
		C																									100%
		D																									100%
		g																									100%
		h																									100%
EDI	Edison	B		2																							100%
EDW	Edwards AFB	B	7	7.13																							100%
		C																									100%
		D																									100%
FEDL	Feedlot or Dairy	B																									100%
		C																									100%
		D																									100%
FEL	Fellows	B																									100%
		C																									100%
		D																									100%
FELF	Foothills above Fellows	B																									100%
		C																									100%
FREM	Fresno MV	B																									100%
		C																									100%
FRES	Residential woodburn	B																									100%
		C																									100%
		D																									100%
		D	6																								100%
FSD	Fresno Drummond	g																									100%
		h																									100%
FSF	Fresno-3425 First St	D																									100%
HAN	Hanford-Irwin St.	g																									100%
		h																									100%
HELM	Agri/Helm-Cent. Fresno	B																									100%
		C																									100%
		D																									100%
KCW	Kettleman City	B																									100%
LVR1	Livermore - New site	B																									100%
		C																									100%

Table C-4. MiniVol Filter Summary - CRPAQS Satellite WINTER Network
(The 15 Winter IOP filters are highlighted and percentage is based only on these filters.)

	WINTER DATE (IOP)		02-Dec	08-Dec	14-Dec	15-Dec	16-Dec	17-Dec	18-Dec	20-Dec	25-Dec	26-Dec	27-Dec	28-Dec	01-Jan	04-Jan	05-Jan	06-Jan	07-Jan	13-Jan	19-Jan	25-Jan	31-Jan	01-Feb	02-Feb	03-Feb	
Site	Name	Type	Seq 68	Seq 69	Seq 70	cz	cz	cz	cz	Seq 72	some	Seq 73	cz	cz	Seq 74	cz	cz	cz	Seq 75	Seq 76	Seq 77	Seq 78	Seq.79	cz	cz	cz	Data
M14	Modesto 14th St.	B																									100%
		C																									100%
		D																									100%
		g																									100%
		h																									100%
MOP	Mojave-Poole	B		6.13	6.13																						100%
		C																									100%
MRM	Merced-midtown	B																									100%
		C																									100%
OLD	Oildale-Manor	B																									100%
		C																									100%
		g																									100%
		h																									100%
OLW	Olancha	B		6.13																							100%
		C																									100%
		D																									100%
PAC1	Pacheco Pass	B										6															93%
PIXL	Pixley Wildlife Refuge	B																									100%
		C																									100%
		D	8																				12				93%
PLE	Pleasant Grove (N.Sac)	B		12																							100%
		C																									100%
S13	Sacramento-1309 T St	B																									100%
		C																									100%
		D																									100%
SDP	Sac-Del PasoManor	D																									100%
SELM	Selma(S.Fresno gradient)	B																									100%
		C		6																							100%
SFA	SanFranciscoArkansas	B																									100%
		C																									100%
SJ4	San Jose-4th Street	D																									100%
SNFH	Sierra Nevada Foothills	B																									100%
		C																									100%
		D																									100%
SOH	Stockton-Hazelton	B																	21								100%
		C																									100%
SWC	SW Chowchilla	B																									100%
		C																									100%
TEH2	Tehachapi Pass	B																					6.13				93%
VCS	Visalia Church St.	B																									100%
		C																									100%
		g																									100%
		h																									100%
YOSE:	YosemiteTurtleback	D																									100%
	Data Capture Rate:					100%	100%	100%	100%			99%	100%	100%		100%	100%	100%	100%				97%	100%	100%	100%	99.7%

APPENDIX D

NEPHELOMETER OPERATIONS AND DATA CAPTURE SUMMARY

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
ALT	Jan-00	3571	2585		data begins 1/19
	Feb-00	8352	15		
	Mar-00	8928	18		
	Apr-00	8640	26		
	May-00	8928	28		
	Jun-00	8640	27		
	Jul-00	8928	21		
	Aug-00	8928	15		
	Sep-00	8640	17		
	Oct-00	8928	14		
	Nov-00	8640	35		
	Dec-00	8928	101		
	01-Jan	8928	56		
	01-Feb	2198	10		data ends 2/8
14-Month	Total:	111177	2968	**97.33%**	
ACP	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	104	0		data begins 11/30
	Dec-00	8928	1409		
	01-Jan	8928	2726		
	01-Feb	1591	11		data ends 2/6
14-Month	Total:	19551	4146	**78.79%**	
BAR	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	122	0		
	Jul-00	8929	31		data begins 6/30
	Aug-00	8928	1046		
	Sep-00	8640	4931		
	Oct-00	8929	877		
	Nov-00	8640	11		
	Dec-00	8928	27		
	01-Jan	8928	11		
	01-Feb	463	9		data ends 2/2
14-Month	Total:	62507	6943	**88.89%**	
BODB	Dec-99	2436	123		data begins 12/23
	Jan-00	8928	3870		
	Feb-00	8352	40		
	Mar-00	8928	921		
	Apr-00	8640	626		
	May-00	2752	5		neph pulled for Fall study 5/10
	Jun-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	7862	21		neph installed 12/4
	01-Jan	8928	2877		
	01-Feb	990	0		data ends 2/4
14-Month	Total:	57816	8483	**85.33%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
BQUC	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	8236	2488		data begins 7/3
	Aug-00	8928	1107		
	Sep-00	2161	0		data ends 9/8
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	0	0		
	01-Jan	0	0		
	01-Feb	0	0		
14-Month	Total:	19325	3595	**81.40%**	
BRE	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	676	0		data begins 11/28
	Dec-00	8928	101		
	01-Jan	8928	52		
	01-Feb	1642	7		data ends 2/6
14-Month	Total:	20174	160	**99.21%**	
BTI	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	4737	11		data begins 3/15
	Apr-00	8640	36		
	May-00	8928	49		
	Jun-00	8640	33		
	Jul-00	8928	22		
	Aug-00	8928	23		
	Sep-00	8640	52		
	Oct-00	1017	0		neph removed for Fall study 10/4
	Nov-00	6152	1690		neph installed 11/9
	Dec-00	8928	22		
	01-Jan	8928	25		
	01-Feb	2785	3		data ends 2/10
14-Month	Total:	85251	1966	**97.69%**	
CAJP	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	2976	499		data begins 7/21
	Aug-00	8928	77		
	Sep-00	2123	0		data ends 9/8
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	0	0		
	01-Jan	0	0		
	01-Feb	0	0		
14-Month	Total:	14027	576	**95.89%**	date begins 7/6
CANT	Jul-00	7344	28		
	Aug-00	8928	648		
	Sep-00	2979	0		data ends 9/11
14-Month	Total:	19251	676	**96.49%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
CARP	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	8753	297		data begins 7/1
	Aug-00	8928	2134		
	Sep-00	8640	5215		
	Oct-00	1329	7		neph removed for Fall
	Nov-00	0	0		
	Dec-00	7631	572		neph installed 12/5
	01-Jan	8928	29		
	01-Feb	1911	11		data ends 2/7
14-Month	Total:	46120	8265	**82.08%**	
CHL	Jan-00	0	0		
	Feb-00	3600	112		data begins 2/17
	Mar-00	8928	5449		
	Apr-00	8640	2028		
	May-00	8928	292		
	Jun-00	8640	546		
	Jul-00	8928	1089		
	Aug-00	8928	529		
	Sep-00	8640	239		
	Oct-00	8928	525		
	Nov-00	8640	15		
	Dec-00	8928	38		
	01-Jan	8928	28		
	01-Feb	1317	9		data ends 2/5
14-Month	Total:	101973	10899	**89.31%**	
CLO	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	7052	143		data begins 12/7
	01-Jan	8928	20		
	01-Feb	1060	1		data ends 2/4
14-Month	Total:	17040	164	**99.04%**	
COP	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	8856	40		data begins 12/1
	01-Jan	8928	27		
	01-Feb	1584	12		data ends 2/6
14-Month	Total:	19368	79	**99.59%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
CRLD	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	6479	34		data begins 8/9
	Sep-00	8640	226		
	Oct-00	1337	0		neph removed for Fall study 10/5
	Nov-00	471	3		neph installed 11/29
	Dec-00	8928	29		
	01-Jan	8928	13		
	01-Feb	1912	14		data ends 2/7
14-Month	Total:	36695	319	**99.13%**	
DUB	Jan-00	3307	22		data begins 1/20
	Feb-00	8352	24		
	Mar-00	8928	20		
	Apr-00	8640	30		
	May-00	8928	25		
	Jun-00	8640	29		
	Jul-00	8928	70		
	Aug-00	8928	23		
	Sep-00	8640	23		
	Oct-00	1056	12		neph removed for Fall study 10/4
	Nov-00	2426	63		neph installed 11/22
	Dec-00	8928	65		
	01-Jan	8928	57		
	01-Feb	5610	5		data ends 2/20
14-Month	Total:	100239	468	**99.53%**	
EDI	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	737	0		data begins 11/28
	Dec-00	8928	75		
	01-Jan	8928	97		
	01-Feb	1603	8		data ends 2/6
14-Month	Total:	20196	180	**99.11%**	
FEDL	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	7488	38		data begins 7/6
	Aug-00	8928	407		
	Sep-00	8640	53		
	Oct-00	8928	53		
	Nov-00	8640	1116		
	Dec-00	8928	581		
	01-Jan	8928	728		
	01-Feb	1267	0		data ends 2/5
14-Month	Total:	61747	2976	**95.18%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
FEL	Jan-00	0	0		
	Feb-00	8364	750		data begins 2/1
	Mar-00	8928	1231		
	Apr-00	8640	427		
	May-00	8928	544		
	Jun-00	8640	854		
	Jul-00	8928	4227		
	Aug-00	8928	5522		
	Sep-00	8640	5086		
	Oct-00	1332	151		neph removed for Fall study 10/5
	Nov-00	0	0		
	Dec-00	7662	23		neph installed 12/5
	01-Jan	8928	40		
	01-Feb	1874	9		data ends 2/7
14-Month	Total:	89792	18864	**78.99%**	
FELF	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	4128	640		data begins 3/17
	Apr-00	8640	421		
	May-00	8928	602		
	Jun-00	8640	950		
	Jul-00	8928	2172		
	Aug-00	8928	2233		
	Sep-00	8640	3715		
	Oct-00	1309	6		neph removed for Fall study 10/5
	Nov-00	0	0		
	Dec-00	7666	47		neph installed 12/5
	01-Jan	8928	27		
	01-Feb	1890	8		data to 2/7
14-Month	Total:	76625	10821	**85.88%**	
FREM	Jan-00	2998	5		data begins 1/21
	Feb-00	8352	888		
	Mar-00	8928	777		
	Apr-00	8640	57		
	May-00	8928	26		
	Jun-00	8640	848		
	Jul-00	8928	254		
	Aug-00	8928	18		
	Sep-00	8640	562		
	Oct-00	8928	252		
	Nov-00	8640	848		
	Dec-00	8928	41		
	01-Jan	8928	13		
	01-Feb	1014	6		data ends 2/4
14-Month	Total:	109420	4595	**95.80%**	
FRES	Jan-00	672	0		data begins 1/29
	Feb-00	8352	574		
	Mar-00	8928	779		
	Apr-00	8640	29		
	May-00	8928	29		
	Jun-00	8640	842		
	Jul-00	8928	249		
	Aug-00	8928	13		
	Sep-00	8640	563		
	Oct-00	8928	257		
	Nov-00	8640	846		
	Dec-00	8928	47		
	01-Jan	8928	2632		
	01-Feb	1027	3		data ends 2/4
14-Month	Total:	107107	6863	**93.59%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
HELM	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	216	0		data begins 11/30
	Dec-00	8928	23		
	01-Jan	8928	19		
	01-Feb	1283	2		data ends 2/5
14-Month	Total:	19355	44	**99.77%**	
KCW	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	981	0		data begins 11/27
	Dec-00	8928	572		
	01-Jan	8928	49		
	01-Feb	2141	11		data ends 2/8
14-Month	Total:	20978	632	**96.99%**	
KRV	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	4445	26		data begins 3/16
	Apr-00	8640	288		
	May-00	8928	59		
	Jun-00	8640	687		
	Jul-00	8928	19		
	Aug-00	8928	14		
	Sep-00	8640	790		
	Oct-00	3336	5		neph removed for Fall study 10/12
	Nov-00	135	3		neph installed 11/30
	Dec-00	8928	38		
	01-Jan	8928	12		
	01-Feb	2205	12		data ends 2/8
14-Month	Total:	80681	1953	**97.58%**	
LVR	Jan-00	0	0	**#REF!**	
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	3284	18		data begins 11/19
	Dec-00	8928	77		
	01-Jan	8928	84		
	01-Feb	1441	0		relevent data ends 2/5
14-Month	Total:	22581	179	**99.21%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
M14	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	8678	1123		data begins 12/1
	01-Jan	8928	11		
	01-Feb	1386	1		data ends 2/5
14-Month	Total:	18992	1135	**94.02%**	
MRM	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	8928	42		data begins 12/1
	01-Jan	8928	12		
	01-Feb	1308	8		data ends 2/5
14-Month	Total:	19164	62	**99.68%**	
OLD	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	717	0		data begins 11/28
	Dec-00	8928	35		
	01-Jan	8928	25		
	01-Feb	1573	8		data ends 2/6
14-Month	Total:	20146	68	**99.66%**	
OLW	Jan-00	0	0		
	Feb-00	3624	138		data begins 2/17
	Mar-00	8928	5452		
	Apr-00	8640	1630		
	May-00	8928	274		
	Jun-00	8640	569		
	Jul-00	8928	857		
	Aug-00	8928	466		
	Sep-00	8640	3150		
	Oct-00	8928	506		
	Nov-00	8640	13		
	Dec-00	8928	53		
	01-Jan	8928	38		
	01-Feb	1285	8		data ends 2/5
14-Month	Total:	101965	13154	**87.10%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
PAC	Jan-00	0	0		
	Feb-00	7620	496		data begins 2/3
	Mar-00	8928	1156		
	Apr-00	8641	312		
	May-00	8928	18		
	Jun-00	8640	859		
	Jul-00	8928	76		
	Aug-00	8928	8		
	Sep-00	8640	246		
	Oct-00	8928	12		
	Nov-00	8640	13		
	Dec-00	8928	27		
	01-Jan	8928	46		
	01-Feb	1944	22		data ends 2/7
14-Month	Total:	106621	3291	**96.91%**	
PIX	Jan-00	1612	3		data begins 1/26
	Feb-00	8352	379		
	Mar-00	8928	1589		
	Apr-00	8640	476		
	May-00	8928	627		
	Jun-00	8640	743		
	Jul-00	8928	215		
	Aug-00	8928	2447		
	Sep-00	8640	5168		
	Oct-00	8928	356		
	Nov-00	8640	59		
	Dec-00	8928	51		
	01-Jan	8928	129		
	01-Feb	1836	9		data ends 2/7
14-Month	Total:	108856	12251	**88.75%**	
PLE	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	424	13		data begins 11/29
	Dec-00	8928	239		
	01-Jan	8928	231		
	01-Feb	1322	8		data ends 2/5
14-Month	Total:	19602	491	**97.50%**	
SELM	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	4404	86		data begins 3/16
	Apr-00	8640	515		
	May-00	8928	56		
	Jun-00	8640	597		
	Jul-00	8928	19		
	Aug-00	8928	12		
	Sep-00	8640	531		
	Oct-00	8928	260		
	Nov-00	8640	1132		
	Dec-00	8928	50		
	01-Jan	8929	9		
	01-Feb	1300	0		data ends 2/5
14-Month	Total:	93833	3267	**96.52%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
SFA	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	3320	24		data begins 11/19
	Dec-00	8928	36		
	01-Jan	8928	3549		
	01-Feb	3035	1		data ends 2/11
14-Month	Total:	24211	3610	**85.09%**	
SLDC	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	120	0		data begins 6/30
	Jul-00	8928	141		
	Aug-00	8928	1881		
	Sep-00	2147	1018		data ends 9/8
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	0	0		
	01-Jan	0	0		
	01-Feb	0	0		
14-Month	Total:	20123	3040	**84.89%**	
SNFH	Jan-00	2683	22		data begins 1/22
	Feb-00	8352	890		
	Mar-00	8928	515		
	Apr-00	8640	281		
	May-00	8928	41		
	Jun-00	8640	568		
	Jul-00	8928	47		
	Aug-00	8928	17		
	Sep-00	8640	817		
	Oct-00	8928	275		
	Nov-00	8640	899		
	Dec-00	8928	26		
	01-Jan	8928	37		
	01-Feb	2173	9		data ends 2/8
14-Month	Total:	110264	4444	**95.97%**	
SOH	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	377	2		data begins 11/29
	Dec-00	8928	107		
	01-Jan	8928	68		
	01-Feb	2219	8		data ends 2/8
14-Month	Total:	20452	185	**99.10%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
SWC	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	576	169		data begins 11/29
	Dec-00	8928	43		
	01-Jan	8928	12		
	01-Feb	1337	1		data ends 2/5
14-Month	Total:	19769	225	**98.86%**	
TEH	Jan-00	0	0		
	Feb-00	5580	2102		data begins 2/10
	Mar-00	8928	3228		
	Apr-00	8640	1117		
	May-00	8928	24		
	Jun-00	8640	582		
	Jul-00	8928	2617		
	Aug-00	8928	637		
	Sep-00	8640	240		
	Oct-00	8928	657		
	Nov-00	8640	1113		
	Dec-00	8928	41		
	01-Jan	8928	30		
	01-Feb	1353	8		data ends 2/5
14-Month	Total:	103989	12396	**88.08%**	
TEJ	Jan-00	0	0		
	Feb-00	4188	711		data begins 2/15
	Mar-00	8928	7080		
	Apr-00	8640	223		
	May-00	8928	306		
	Jun-00	8640	4615		
	Jul-00	8928	27		
	Aug-00	8928	776		
	Sep-00	8640	1921		
	Oct-00	8928	1977		
	Nov-00	8640	5703		
	Dec-00	8928	38		
	01-Jan	8928	454		
	01-Feb	2171	17		data ends 2/8
14-Month	Total:	103415	23848	**76.94%**	
VCS	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	0	0		
	Sep-00	0	0		
	Oct-00	0	0		
	Nov-00	144	0		data begin 11/30
	Dec-00	8928	31		
	01-Jan	8928	13		
	01-Feb	1559	0		data ends 2/6
14-Month	Total:	19559	44	**99.78%**	

Table D-1. Data Capture Rates for Nephelometers - CRPAQS Annual Satellite Network Program

SITE	MONTH YR	Number of Records POSSIBLE	INVALID OR MISSING	DATA CAPTURE RATE (percentage)	COMMENTS
WAG	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	0	0		
	Aug-00	4782	34		data begins 8/15
	Sep-00	8640	58		
	Oct-00	8928	1054		
	Nov-00	8640	752		
	Dec-00	8928	24		
	01-Jan	8928	14		
	01-Feb	414	0		data ends 2/2
14-Month	Total:	49260	1936	**96.07%**	
WLKP	Jan-00	0	0		
	Feb-00	0	0		
	Mar-00	0	0		
	Apr-00	0	0		
	May-00	0	0		
	Jun-00	0	0		
	Jul-00	8128	34		data begins 7/3
	Aug-00	8928	599		
	Sep-00	2989	2		data ends 9/11
	Oct-00	0	0		
	Nov-00	0	0		
	Dec-00	0	0		
	01-Jan	0	0		
	01-Feb	0	0		
14-Month	Total:	20045	635	**96.83%**	

APPENDIX E

MINIVOL CALIBRATION DATA AND SET POINT SUMMARY

Appendix E – MiniVol Calibration Data and Set Point Summary

						As Found			Left As		
Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	Indicated Set Point	MiniVol Flow (lpm)	Reference Flow (lpm)	Indicated Set Point	Reference Flow (lpm)	Comments
ACP	05/26/2000	b	1321	28.6	967	5.5	5.5	5.2	5.0	4.9	ARS Calib., reset
ACP	05/26/2000	c	976	28.6	967	5.4	5.4	5.2	5.0	4.9	ARS Calib., reset
ACP	12/08/2000	b	1114	22.0	729	5.4	5.4	5.5	5.1	5.1	ARS Calib., reset
ACP	12/08/2000	c	975	22.0	729	5.3	5.3	5.3	5.1	5.1	ARS Calib., reset
ACP	12/08/2000	c	976	22.0	729	5.0	5.0	5.0	5.1	5.1	ARS Calib., reset
ACP	12/08/2000	b	1321	22.0	729	5.0	5.1	5.1	5.1	5.1	ARS Calib., reset
ALT1	05/23/2000	b	1313	34.0	971	5.6	5.9	5.8	5.2	4.9	ARS Calib., reset
ALT1	11/30/2000	b	1155	6.0	980	NA	5.5	5.3	5.1	5.1	ARS Calib., reset
ALT1	12/01/2000	b	1313	6.0	980	4.8	4.9	4.9	5.1	5.1	ARS Calib., reset
ALT1	12/16/2000	b	1313	14.1	984	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
ALT1	12/16/2000	b	1155	14.1	984	5.1	5.2	5.1	5.1	5.1	CRPAQS Auditor
ANGI	05/31/2000	d	1187	30.0	1002	4.8	4.9	4.7	5.0	4.9	ARS Calib., reset
BAC	06/01/2000	d	1278	31.9	996	5.9	5.9	5.7	5.0	4.9	ARS Calib., reset
BAC	12/06/2000	d	1278	19.0	1006	5.0	5.0	4.9	5.1	5.1	ARS Calib., reset
BGS	05/31/2000	h	1223	27.8	999	5.5	5.7	5.6	5.0	4.9	ARS Calib., reset
BGS	05/31/2000	g	1280	27.8	999	5.5	5.5	5.3	5.1	4.9	ARS Calib., reset
BGS	12/06/2000	h	1223	16.0	1006	5.0	5.1	5.1	5.1	5.1	ARS Calib., reset
BGS	12/06/2000	g	1280	16.0	1006	5.1	5.2	5.1	5.1	5.1	ARS Calib., reset
BGS	01/11/2001	g	1280	11.7	998	5.1	5.1	5.0	5.1	4.9	CRPAQS Auditor
BGS	01/11/2001	h	1223	11.7	998	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
BRES	06/01/2000	c	1219	35.6	996	5.5	5.4	5.3	5.0	4.9	ARS Calib., reset
BRES	06/01/2000	b	1099	35.6	996	5.6	5.7	5.5	5.0	4.9	ARS Calib., reset
BRES	12/04/2000	b	1099	8.0	1006	5.0	4.9	4.9	5.1	5.1	ARS Calib., reset
BRES	12/04/2000	c	1219	8.0	1006	5.0	5.1	4.7	5.1	5.1	ARS Calib., reset
BRES	12/04/2000	c	993	8.0	1006	5.0	5.1	5.4	5.1	5.1	ARS Calib., reset
BRES	12/04/2000	b	1004	8.9	1006	5.3	5.2	5.2	5.2	5.1	ARS Calib., reset
BRES	01/10/2001	b	1099	12.8	989	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
BRES	01/10/2001	b	1004	12.8	989	5.2	5.2	5.2	5.2	5.2	CRPAQS Auditor
BRES	01/10/2001	c	1219	12.8	989	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
BRES	01/10/2001	c	0993	12.8	989	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
BTI	05/23/2000	c	1109	38.0	1009	5.6	5.6	5.4	5.1	5.0	ARS Calib., reset
BTI	05/23/2000	b	973	38.0	1009	5.7	5.9	5.9	5.1	5.0	ARS Calib., reset
BTI	05/23/2000	d	1204	38.0	1009	NA	5.7	5.7	5.2	5.0	ARS Calib., reset
BTI	11/30/2000	b	973	9.0	1026	NA	5.2	5.1	5.2	5.2	ARS Calib., reset
BTI	11/30/2000	d	1204	9.0	1023	5.1	5.1	5.1	5.2	5.2	ARS Calib., reset
BTI	11/30/2000	c	1109	9.0	1026	5.6	5.3	5.2	5.3	5.2	ARS Calib., reset
BTI	12/15/2000	b	0973	15.0	1025	5.2	5.1	5.0	5.2	5.0	CRPAQS Auditor
BTI	12/15/2000	c	1109	15.0	1025	5.2	5.1	5.0	5.2	5.0	CRPAQS Auditor
BTI	12/15/2000	d	1204	15.0	1025	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
CARP	05/31/2000	b	1269	27.2	943	5.6	5.6	5.4	4.9	4.9	ARS Calib., reset
CARP	12/06/2000	b	1269	6.8	951	4.9	4.9	4.9	5.1	5.1	ARS Calib., reset
CARP	01/09/2001	b	1269	12.3	942	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditor
CHLV	06/02/2000	d	1141	36.0	935	5.3	5.2	5.1	4.7	4.6	ARS Calib., reset
CHLV	06/02/2000	c	1142	36.0	935	5.0	5.0	5.1	4.7	4.6	ARS Calib., reset
CHLV	06/02/2000	b	1157	36.0	935	5.1	5.1	5.1	4.7	4.6	ARS Calib., reset
CHLV	12/07/2000	b	1157	18.0	935	4.7	4.7	4.5	4.9	4.8	ARS Calib., reset
CHLV	12/07/2000	c	1329	18.0	935	4.7	4.7	4.4	5.1	4.8	ARS Calib., reset
CHLV	12/07/2000	d	1154	18.0	935	4.9	4.8	4.6	5.0	4.8	ARS Calib., reset
CHLV	01/12/2001	b	1157	8.7	931	4.9	4.8	4.5	4.9	4.5	CRPAQS Auditor
CHLV	01/12/2001	c	1329	8.7	931	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
CHLV	01/12/2001	d	1154	8.7	931	5.0	5.0	5.0	5.0	5.0	CRPAQS Auditor
CLO	05/29/2000	b	1274	22.4	1001	5.7	5.7	5.6	5.1	4.9	ARS Calib., reset
CLO	05/29/2000	c	1344	22.4	1001	5.5	5.6	5.5	5.0	4.9	ARS Calib., reset
CLO	12/07/2000	c	1001	17.7	754	5.4	5.4	5.4	5.2	5.2	ARS Calib., reset
CLO	12/07/2000	b	1215	14.5	754	5.0	5.1	5.3	5.2	5.2	ARS Calib., reset
CLO	12/07/2000	c	1344	14.5	754	5.0	5.0	5.1	5.2	5.2	ARS Calib., reset
CLO	12/07/2000	b	1333	17.7	754	5.5	5.5	5.5	NA	5.2	ARS Calib., reset
CLO	12/15/2000	b	1215	10.9	1013	5.2	5.1	5.1	5.2	5.1	CRPAQS Auditor
CLO	12/15/2000	c	1001	10.9	1013	5.1	5.2	5.0	5.1	5.0	CRPAQS Auditor
CLO	12/15/2000	b	1333	10.9	1013	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
CLO	12/15/2000	c	1344	10.9	1013	NA	NA	NA	NA	NA	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
CO5	10/24/2000	g	1142	23.3	1013	5.4	5.5	5.2	5.4	5.2	CRPAQS Auditor
COP	05/30/2000	d	1185	31.0	1004	5.3	5.3	5.1	5.1	4.9	ARS Calib., reset
COP	05/30/2000	g	1170	31.0	1004	5.3	5.3	5.2	5.3	5.2	ARS Calib., reset
COP	05/30/2000	b	1332	31.0	1004	5.5	5.5	5.3	5.1	4.9	ARS Calib., reset
COP	05/30/2000	c	1167	31.0	1004	5.4	5.4	5.3	5.1	4.9	ARS Calib., reset
COP	05/30/2000	h	1011	31.0	1004	5.3	5.3	5.3	5.0	4.9	ARS Calib., reset
COP	10/23/2000	h	1001	15.4	1007	5.4	5.3	5.2	5.3	5.2	CRPAQS Auditor
COP	10/23/2000	g	1272	15.4	1007	6.4	6.6	5.5	6.4	5.5	CRPAQS Auditor
COP	10/23/2000	i	1323	15.4	1007	5.4	5.5	5.3	5.4	5.3	CRPAQS Auditor
COP	10/24/2000	h	1001	15.4	1007				5.4	5.0	Set By Auditor
COP	10/24/2000	i	1323	15.4	1007				5.4	5.0	Set By Auditor
COP	12/04/2000	c	1167	10.5	763	5.1	5.1	5.2	5.2	5.2	ARS Calib., reset
COP	12/04/2000	b	1332	10.5	763	5.1	5.1	5.3	5.2	5.2	ARS Calib., reset
COP	12/04/2000	g	1170	10.6	763	5.0	4.9	4.9	5.2	5.2	ARS Calib., reset
COP	12/04/2000	h	1011	10.6	763	5.0	5.0	4.9	5.2	5.2	ARS Calib., reset
COP	12/04/2000	d	1185	8.1	763	5.1	5.1	5.3	5.2	5.2	ARS Calib., reset
DAIP	10/23/2000	g	1132	21.9	1008	6.2	6.3	6.3	6.2	6.3	CRPAQS Auditor
DAIU	10/23/2000	g	1333	23.1	1008	6.5	6.5	6.4	6.5	6.4	CRPAQS Auditor
EDI	06/01/2000	b	1277	35.0	996	5.5	5.5	5.4	5.0	4.9	ARS Calib., reset
EDI	12/06/2000	b	1277	15.0	106	5.0	4.9	4.8	5.1	5.1	ARS Calib., reset
EDI	12/06/2000	b	1182	15.0	1006	5.4	5.5	5.4	5.0	5.1	ARS Calib., reset
EDI	01/11/2001	b	1277	16.0	996	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
EDI	01/11/2001	b	1182	16.0	996	5.0	NA	4.9	5.0	4.9	CRPAQS Auditor
EDW	06/02/2000	d	1311	32.2	932	5.0	5.0	5.0	4.8	4.7	ARS Calib., reset
EDW	06/02/2000	b	992	32.2	932	5.8	5.8	5.7	4.8	4.7	ARS Calib., reset
EDW	06/02/2000	c	1310	32.2	932	5.7	5.8	5.6	4.8	4.7	ARS Calib., reset
EDW	12/08/2000	c	977	19.0	929	NA	4.9	4.8	5.0	4.9	ARS Calib., reset
EDW	12/08/2000	d	1311	19.0	929	4.8	4.7	4.6	4.9	4.9	ARS Calib., reset
EDW	12/08/2000	b	992	19.0	929	4.8	4.8	4.7	5.0	4.9	ARS Calib., reset
FEDL	12/05/2000	b	1218	10.4	760	5.7	5.7	5.7	5.2	5.2	ARS Calib., reset
FEDL	12/05/2000	c	1106	10.4	760	5.2	5.3	5.3	5.2	5.2	ARS Calib., reset

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
FEDL	12/05/2000	d	1100	10.4	760	5.2	5.4	5.4	5.2	5.2	ARS Calib., reset
FEDL	12/05/2000	c	1340	10.4	760	NA	NA	NA	5.2	5.2	ARS Calib., reset
FEDL	12/05/2000	b	1316	10.4	760	NA	NA	NA	5.2	5.2	ARS Calib., reset
FEDL	01/08/2001	b	1218	12.2	1002	5.2	5.3	5.2	5.2	5.2	CRPAQS Auditor
FEDL	01/08/2001	c	1106	12.2	1002	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
FEDL	01/08/2001	d	1100	12.2	1002	5.2	5.0	4.9	5.2	4.9	CRPAQS Auditors
FEDL	01/08/2001	c	1340	12.2	1002	5.2	5.1	5.0	5.2	5.0	CRPAQS Auditors
FEDL	01/08/2001	b	1316	12.2	1002	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditors
FEL	05/31/2000	b	1322	27.0	971	5.7	5.7	5.6	5.0	4.9	ARS Calib., reset
FEL	05/31/2000	c	1195	27.0	971	5.6	5.6	5.5	5.0	4.9	ARS Calib., reset
FEL	05/31/2000	d	1216	27.0	971	5.8	5.8	5.7	5.0	4.9	ARS Calib., reset
FEL	01/09/2001	b	1322	12.8	977	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
FEL	01/09/2001	c	1195	12.8	977	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
FEL	01/09/2001	d	1216	12.8	977	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
FEL	01/09/2001	c	0985	12.8	977	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditor
FEL	01/09/2001	b	1334	12.8	977	NA	NA	NA	NA	NA	CRPAQS Auditor
FEL	12/05/2000	b	1334	15.0	978	5.4	5.0	7.7	3.6	5.1	ARS Calib., reset
FEL	12/05/2000	c	985	15.6	978	5.5	5.5	5.3	5.1	5.1	ARS Calib., reset
FEL	12/05/2000	c	1195	15.2	978	5.0	5.0	4.9	5.1	5.1	ARS Calib., reset
FEL	12/05/2000	d	1216	15.0	978	5.0	5.1	5.1	5.1	5.1	ARS Calib., reset
FEL	12/05/2000	b	1322	15.0	978	5.0	5.0	4.9	5.1	5.1	ARS Calib., reset
FELF	05/31/2000	c	1012	27.0	973	5.3	5.4	5.4	4.8	4.9	ARS Calib., reset
FELF	05/31/2000	b	1153	27.0	973	5.5	5.7	5.7	5.0	4.9	ARS Calib., reset
FELF	12/05/2000	c	1140	19.0	959	5.3	5.5	5.3	5.1	5.1	ARS Calib., reset
FELF	12/05/2000	b	1153	19.0	959	5.0	5.1	5.0	5.1	5.1	ARS Calib., reset
FELF	12/05/2000	c	1012	19.0	959	4.8	4.8	4.9	5.1	5.1	ARS Calib., reset
FELF	01/09/2001	c	1012	7.6	954	5.1	5.0	5.0	5.1	5.0	CRPAQS Auditor
FELF	01/09/2001	b	1153	7.6	954	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
FELF	01/09/2001	b	1132	7.6	954	5.1	5.2	5.2	5.1	5.2	CRPAQS Auditor
FELF	01/09/2001	c	1140	7.6	954	NA	NA	NA	NA	NA	CRPAQS Auditor
FREM	05/30/2000	b	767	21.8	1002	5.7	5.6	5.5	5.0	4.9	ARS Calib., reset

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
FREM	05/30/2000	c	1178	21.8	1002	5.6	5.6	5.5	5.1	4.9	ARS Calib., reset
FREM	12/15/2000	b	0097	18.1	1013	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
FREM	12/15/2000	c	1178	18.1	1013	5.2	5.1	4.9	5.2	4.9	CRPAQS Auditor
FREM	12/15/2000	c	1018	18.1	1013	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
FREM	12/15/2000	b	1178	18.1	1013	5.2	5.1	5.0	5.2	5.0	CRPAQS Auditor
FREM	12/06/2000	b	767	7.2	761	5.0	5.0	5.3	5.2	5.2	ARS Calib., reset
FREM	12/06/2000	b	1178	7.2	761	5.1	5.1	5.3	5.2	5.2	ARS Calib., reset
FREM	12/06/2000	c	1018	7.2	761	5.4	5.4	5.5	5.2	5.2	ARS Calib., reset
FRES	05/29/2000	d	1271	30.0	1002	5.4	5.4	5.1	5.1	4.9	ARS Calib., reset
FRES	05/29/2000	c	1177	30.0	1002	5.6	5.7	5.4	5.0	4.9	ARS Calib., reset
FRES	05/29/2000	b	1199	30.0	1002	5.7	5.8	5.7	5.1	4.9	ARS Calib., reset
FRES	12/15/2000	c	1177	14.0	1015	5.2	5.1	4.9	5.2	4.9	CRPAQS Auditor
FRES	12/15/2000	d	1271	14.0	1015	5.2	5.2	4.7	5.2	4.7	CRPAQS Auditor
FRES	12/15/2000	b	1199	14.0	1015	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
FRES	12/15/2000	c	1343	14.0	1015	5.2	5.2	4.9	5.2	4.9	CRPAQS Auditor
FRES	12/15/2000	b	0596	14.0	1015	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
FRES	12/06/2000	c	1343	13.3	760	NA	5.0	5.1		5.2	ARS Calib., reset
FRES	12/06/2000	b	596	13.3	760	5.2	5.4	5.4	5.1	5.2	ARS Calib., reset
FRES	12/06/2000	d	1271	13.3	760	5.1	5.0	5.0	5.2	5.2	ARS Calib., reset
FRES	12/06/2000	c	1177	13.3	760	5.0	5.0	5.0	5.2	5.2	ARS Calib., reset
FRES	12/06/2000	b	1199	13.3	760	5.1	5.1	5.1	5.2		ARS Calib., reset
FSD	05/29/2000	h	1275	31.4	1002	5.5	5.5	5.4	5.0	4.9	ARS Calib., reset
FSD	05/29/2000	g	970	31.4	1002	5.6	5.7	5.6	5.0	4.9	ARS Calib., reset
FSD	12/15/2000	g	0970	11.5	1017	5.2	5.1	5.1	5.2	5.1	CRPAQS Auditor
FSD	12/15/2000	h	1275	11.5	1017	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
FSD	12/06/2000	h	1275	12.0	760	5.0	5.0	5.0	5.2	5.2	ARS Calib., reset
FSD	12/06/2000	g	970	12.0	760	5.0	5.0	5.0	5.2	5.2	ARS Calib., reset
FSF	05/29/2000	d	1139	25.5	1002	5.6	5.5	5.5	5.0	4.9	ARS Calib., reset
FSF	12/07/2000	d	1325	12.7	757	NA	5.0	4.9	5.2	5.2	ARS Calib., reset
GRA	10/23/2000	h	1183	21.0	1007	5.4	5.6	5.4	5.4	5.4	CRPAQS Auditor
GRA	10/23/2000	g	1004	21.0	1007	5.3	5.5	5.2	5.3	5.2	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
GRA	10/23/2000	i	1310	21.0	1007	5.4	5.6	5.4	5.4	5.4	CRPAQS Auditor
GRA	10/23/2000	i	1310	21.0	1007				5.4	5.0	Set By Auditor
GRAS	10/24/2000	h	1122	28.6	1012	5.3	5.5	5.3			CRPAQS Auditor
GRAS	10/24/2000	h	1122	28.6	1012				5.3	5.0	Set By Auditor
GRAS	10/24/2000	g	1136	28.6	1012	5.4	5.5	4.9	5.4	4.9	CRPAQS Auditor
GRAS	10/24/2000	i	1127	28.6	1012	5.4	5.5	5.2			CRPAQS Auditor
GRAS	10/24/2000	i	1127	28.6	1012				5.4	5.0	Set By Auditor
H43	10/23/2000	h	1213	26.6	1007	5.4	5.5	5.3			CRPAQS Auditor
H43	10/23/2000	h	1213	26.6	1007				5.4	5.0	Set By Auditor
H43	10/23/2000	g	986	26.6	1007	5.4	5.5	5.3	5.4	5.3	CRPAQS Auditor
H43	10/23/2000	i	1133	26.6	1007	5.4	5.6	5.1			CRPAQS Auditor
H43	10/23/2000	i	1133	26.6	1007				5.4	5.0	Set By Auditor
HAN	05/30/2000	g	1124	33.3	1005	5.3	5.2	5.2	5.0	4.9	ARS Calib., reset
HAN	05/30/2000	h	969	33.3	1005	5.4	5.4	5.3	5.0	4.9	ARS Calib., reset
HAN	10/24/2000	h	1123	12.5	1011	5.4	5.6	5.3			CRPAQS Auditor
HAN	10/24/2000	h	1123	12.5	1011				5.4	5.0	Set By Auditor
HAN	10/24/2000	g	974	12.5	1011	5.3	5.4	5.1	5.3	5.1	CRPAQS Auditor
HAN	10/24/2000	i	1111	12.5	1011	5.4	5.6	5.3			CRPAQS Auditor
HAN	10/24/2000	h	1123	12.5	1011				5.4	5.0	Set By Auditor
HAN	12/04/2000	h	766	10.0	760	4.7	5.0	5.1	5.2	5.2	ARS Calib., reset
HAN	12/04/2000	g	1124	10.0	760	5.0	5.1	5.3	5.2	5.2	ARS Calib., reset
HELM	05/29/2000	d	995	32.7	1004	5.5	5.5	5.3	5.1	4.9	ARS Calib., reset
HELM	05/29/2000	c	1014	32.7	1004	4.5	4.7	6.5	3.8	4.9	ARS Calib., reset
HELM	05/29/2000	b	1000	32.7	1004	5.7	5.7	5.6	5.0	4.9	ARS Calib., reset
HELM	12/05/2000	c	1129	13.0	762	5.3	5.4	5.4	5.2	5.2	ARS Calib., reset
HELM	12/05/2000	b	1152	13.0	762	5.4	5.4	5.6	5.0	5.2	ARS Calib., reset
HELM	12/05/2000	d	995	13.0	768	5.1	5.0	5.0	5.2	5.2	ARS Calib., reset
HELM	12/05/2000	c	991	13.0	762	5.2	5.0	5.2	5.0	5.2	ARS Calib., reset
HELM	12/05/2000	b	1000	13.0	762	5.0	5.1	5.2	5.1	5.2	ARS Calib., reset
KCW	06/03/2000	b	1328	27.4	1009	5.8	5.8	5.6	5.0	4.9	ARS Calib., reset
KCW	01/10/2001	b	1328	7.8	1001	5.1	5.0	4.8	5.1	4.8	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
KCW	01/10/2001	b	1213	7.8	1001	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
KCW	12/07/2000	b	1213	11.3	759	5.4	5.4	5.5		5.2	ARS Calib., reset
KCW	12/07/2000	b	1328	11.3	759	5.0	5.0	5.1	5.1	5.2	ARS Calib., reset
LVR1	05/23/2000	d	1002	38.0	994	NA	5.9	5.8	5.0	5.0	ARS Calib., reset
LVR1	05/23/2000	c	1181	38.0	994	5.6	5.8	5.8	5.0	5.0	ARS Calib., reset
LVR1	05/23/2000	b	1110	38.0	994	5.7	5.9	5.8	5.0	5.0	ARS Calib., reset
LVR1	11/30/2000	b	1002	8.0		4.8	4.8	4.9	5.0	5.2	ARS Calib., reset
LVR1	11/30/2000	c	1181	8.0		NA	5.1	5.1	5.1	5.1	ARS Calib., reset
LVR1	11/30/2000	b	1110	8.0		5.1	5.1	5.1	5.1	5.1	ARS Calib., reset
LVR1	11/30/2000	c	1259	8.0		NA	NA	5.1	5.0	5.1	ARS Calib., reset
LVR1	12/16/2000	b	1110	10.8	1011	5.1	5.1	4.8	5.1	4.8	CRPAQS Auditor
LVR1	12/16/2000	c	1181	10.8	1011	5.1	5.0	4.7	5.1	4.7	CRPAQS Auditor
LVR1	12/16/2000	d	1002	10.8	1011	5.0	5.1	5.0	5.0	5.0	CRPAQS Auditor
LVR1	12/16/2000	c	1259	10.8	1011	5.0	5.0	4.8	5.0	4.8	CRPAQS Auditor
LVR1	12/16/2000	b	1122	10.8	1011	5.1	5.2	5.1	5.1	5.1	CRPAQS Auditor
M14	05/23/2000	h	1191	37.0	1007	5.7	5.8	5.8	5.1	5.0	ARS Calib., reset
M14	05/25/2000	b	1345	37.0	1007	5.6	5.7	5.5	5.1	5.0	ARS Calib., reset
M14	05/25/2000	c	1179	37.0	1007	5.6	5.7	5.5	5.1	5.0	ARS Calib., reset
M14	05/25/2000	d	1174	37.0	1007	5.5	5.5	5.2	5.0	5.0	ARS Calib., reset
M14	05/25/2000	g	1113	37.0	1007	5.7	5.7	5.6	5.2	5.0	ARS Calib., reset
M14	12/01/2000	g	1113	6.0	1021	5.3	5.3	5.3	5.2	5.2	ARS Calib., reset
M14	12/01/2000	c	1151	6.0	1021	5.4	5.4	5.4	5.3	5.1	ARS Calib., reset
M14	12/01/2000	h	1191	6.0	1021	5.2	5.1	5.2	5.2	5.1	ARS Calib., reset
M14	12/01/2000	b	1345	6.0	1021	5.2	5.2	5.2	5.2	5.1	ARS Calib., reset
M14	12/01/2000	c	1179	6.0	1021	5.2	5.2	5.2	5.2	5.1	ARS Calib., reset
M14	12/01/2000	d	1174	6.0	1021	5.1	5.0	5.0	5.1	5.1	ARS Calib., reset
M14	12/01/2000	b	1310	6.0	1021	5.4	5.4	5.3	5.3	5.1	ARS Calib., reset
M14	12/14/2000	c	1179	12.2	1020	5.2	5.2	4.9	5.2	4.9	CRPAQS Auditor
M14	12/14/2000	b	1345	12.2	1020	5.1	5.0	5.0	5.1	5.0	CRPAQS Auditor
M14	12/14/2000	c	1151	12.2	1020	5.3	5.4	5.3	5.3	5.3	CRPAQS Auditor
M14	12/14/2000	b	1310	12.2	1020	5.3	5.4	5.3	5.3	5.3	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
M14	12/14/2000	g	1113	12.2	1020	5.1	5.0	4.9	5.1	5.1	CRPAQS Auditor
M14	12/14/2000	h	1191	12.2	1020	5.2	5.1	4.9	5.2	4.9	CRPAQS Auditor
M14	12/14/2000	d	1174	12.2	1020	5.1	4.9	4.8	5.1	4.8	CRPAQS Auditor
MOP	06/02/2000	b	1016	31.7	921	5.2	5.2	5.1	4.8	4.7	ARS Calib., reset
MOP	06/02/2000	c	1107	31.7	921	5.3	5.3	5.2	4.8	4.7	ARS Calib., reset
MOP	12/08/2000	b	1016	17.0	918	4.8	4.8	4.8	4.8	4.9	ARS Calib., reset
MOP	12/08/2000	c	1209	17.0	918	4.8	4.8	4.7	5.0	4.9	ARS Calib., reset
MRM	05/25/2000	b	1217	39.0	1003	5.8	5.8	4.6	6.3	5.0	ARS Calib., reset
MRM	05/25/2000	c	1106	39.0	1003	5.5	5.5	5.4	5.0	5.0	ARS Calib., reset
MRM	12/01/2000	b	1192	14.0	1013	NA	5.2	5.2	5.2	5.1	ARS Calib., reset
MRM	12/01/2000	c	1111	14.0	1013	NA	5.2	5.2	5.2	5.1	ARS Calib., reset
MRM	12/01/2000	b	1217	14.0	1013	6.4	6.4	5.2	6.4	5.1	ARS Calib., reset
MRM	12/01/2000	c	1005	14.0	1013	5.4	5.4	5.2	5.2	5.1	ARS Calib., reset
MRM	12/14/2000	b	1192	14.3	1016	5.2	5.2	5.2	5.2	5.2	CRPAQS Auditor
MRM	12/14/2000	c	1111	14.3	1016	5.2	5.3	5.1	5.2	5.1	CRPAQS Auditor
MRM	12/14/2000	b	1217	14.3	1016	6.3	6.4	4.4	6.3	4.4	CRPAQS Auditor
MRM	12/14/2000	c	1005	14.3	1016	5.3	5.3	5.1	5.3	5.1	CRPAQS Auditor
OLD	05/31/2000	b	1102	24.5	993	5.6	5.6	5.4	4.9	4.9	ARS Calib., reset
OLD	05/31/2000	c	1154	24.5	993	5.4	5.6	5.4	4.9	4.9	ARS Calib., reset
OLD	05/31/2000	g	1329	24.5	993	5.3	5.3	5.0	5.1	4.9	ARS Calib., reset
OLD	05/31/2000	h	776	24.5	993	5.2	5.2	5.3	4.9	4.9	ARS Calib., reset
OLD	12/06/2000	h	1139	14.0	1007	5.4	5.4	5.3	5.1	5.1	ARS Calib., reset
OLD	12/06/2000	c	1318	14.0	1007	NA	4.9	4.9	5.0	5.1	ARS Calib., reset
OLD	12/06/2000	g	1276	14.0	1007	5.3	5.5	5.4	5.0	5.1	ARS Calib., reset
OLD	12/06/2000	b	1102	14.0	1007	5.0	4.9	4.9	5.1	5.1	ARS Calib., reset
OLD	01/11/2001	c	1318	9.5	989	5.0	5.0	5.0	5.0	5.0	CRPAQS Auditor
OLD	01/11/2001	b	1102	9.5	989	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditor
OLD	01/11/2001	g	1276	9.5	989	5.0	5.0	5.0	5.0	5.0	CRPAQS Auditor
OLD	01/11/2001	h	1139	9.5	989	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
OLW	06/02/2000	b	1117	28.9	890	5.0	5.0	4.9	4.7	4.7	ARS Calib., reset
OLW	06/02/2000	c	1190	28.9	890	5.2	5.3	5.2	4.6	4.7	ARS Calib., reset

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
OLW	06/02/2000	d	972	28.9	890	5.3	5.3	5.2	4.6	4.7	ARS Calib., reset
OLW	12/07/2000	c	1123	4.0	886	5.4	5.4	5.3	5.0	4.9	ARS Calib., reset
OLW	12/07/2000	b	1208	5.0	886	5.4	5.3	5.1	5.1	4.9	ARS Calib., reset
OLW	12/07/2000	b	1117	8.0	886	4.4	4.5	4.5	4.9	4.9	ARS Calib., reset
OLW	12/07/2000	d	972	8.0	886	4.3	4.2	4.2	4.9	4.9	ARS Calib., reset
OLW	12/07/2000	c	1118	4.0	886	NA	5.0	4.8	5.0	4.9	ARS Calib., reset
OLW	01/12/2001	b	1117	3.7	882	4.9	4.9	4.9	4.9	4.9	CRPAQS Auditor
OLW	01/12/2001	c	1118	3.7	882	5.0	5.0	5.1	5.0	5.1	CRPAQS Auditor
OLW	01/12/2001	d	0972	3.7	882	4.9	4.9	4.9	4.9	4.9	CRPAQS Auditor
OLW	01/12/2001	b	1208	3.7	882	5.1	NA	5.3	5.1	5.3	CRPAQS Auditor
OLW	01/12/2001	c	1123	3.7	882	5.0	NA	5.2	5.0	5.2	CRPAQS Auditor
ORE	10/24/2000	g	985	27.7	1009	5.5	5.5	5.1	5.5	5.1	CRPAQS Auditor
PAC1	05/25/2000	b	988	23.0	958	5.8	5.8	5.9	4.9	4.9	ARS Calib., reset
PAC1	12/01/2000	b	988	5.0	967	4.9	4.9	4.8	5.1	5.1	ARS Calib., reset
PIXL	05/31/2000	b	1207	28.3	1002	5.7	5.7	5.4	5.0	4.9	ARS Calib., reset
PIXL	05/31/2000	c	1010	28.3	1002	5.7	5.7	5.5	5.0	4.9	ARS Calib., reset
PIXL	05/31/2000	d	1317	28.3	1002	5.6	5.7	5.5	5.0	4.9	ARS Calib., reset
PIXL	12/06/2000	d	1317	9.0	1011	5.0	4.9	4.9	5.1	5.2	ARS Calib., reset
PIXL	12/06/2000	c	1010	10.0	1011	5.0	5.1	5.1	5.2	5.2	ARS Calib., reset
PIXL	12/06/2000	c	1272	10.0	1011	5.3	5.5	5.3	5.2	5.2	ARS Calib., reset
PIXL	12/06/2000	b	1175	10.0	1011	5.3	5.3	5.7	4.9	5.2	ARS Calib., reset
PIXL	12/06/2000	b	1207	10.8	1011	5.0	5.0	4.9	5.1	5.2	ARS Calib., reset
PIXL	01/10/2001	b	1207	4.8	1005	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
PIXL	01/10/2001	d	1317	4.8	1005	5.1	5.2	5.0	5.1	5.0	CRPAQS Auditor
PIXL	01/10/2001	c	1010	4.8	1005	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
PIXL	01/10/2001	c	1272	4.8	1005	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
PIXL	01/10/2001	b	1175	4.8	1005	4.9	4.9	5.0	4.9	5.0	CRPAQS Auditor
PLE	05/22/2000	b	1150	28.0	1010	4.9	5.5	4.8	6.0	5.0	ARS Calib., reset
PLE	05/22/2000	c	1007	28.0	1010	NA	5.6	5.6	5.3	5.0	ARS Calib., reset
PLE	11/29/2000	b	1003	17.0	1018	4.9	5.1	5.2	5.1	5.2	ARS Calib., reset
PLE	12/13/2000	c	1007	12.0	1014	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
PLE	12/13/2000	b	1003	12.0	1014	5.2	5.1	5.1	5.2	5.1	CRPAQS Auditor
S13	05/22/2000	d	971	42.0	1010	NA	5.7	5.4	5.2	5.0	ARS Calib., reset
S13	05/22/2000	b	1108	42.0	1010	5.8	5.8	5.6	5.2	5.0	ARS Calib., reset
S13	11/29/2000	b	1116	19.0	1019	4.5	4.5	5.5	5.2	5.2	ARS Calib., reset
S13	11/29/2000	c	1270	19.0	1019	4.9	4.9	4.9	5.2	5.2	ARS Calib., reset
S13	11/29/2000	b	1108	19.0	1019	4.8	5.1	5.1	5.2	5.2	ARS Calib., reset
S13	11/29/2000	d	1101	19.0	1019	NA	NA	NA	5.2	5.2	ARS Calib., reset
S13	12/13/2000	b	1108	10.0	1016	5.2	5.2	5.0	5.2	5.0	CRPAQS Auditor
S13	12/13/2000	d	1101	10.0	1016	5.3	5.2	5.1	5.3	5.1	CRPAQS Auditor
S13	12/13/2000	c	1270	10.0	1016	5.3	5.2	5.1	5.3	5.1	CRPAQS Auditor
S13	12/13/2000	c	1112	10.0	1016	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
SDP	05/22/2000	d	1186	43.0	1008	5.1	5.8	5.8	5.0	5.0	ARS Calib., reset
SDP	11/29/2000	d	1186	19.0	1018	5.1	5.0	4.9	5.2	5.2	ARS Calib., reset
SELM	05/29/2000	b	1275	33.0	1001	5.1	5.2	5.7	4.6	4.9	ARS Calib., reset
SELM	05/29/2000	b	997	33.0	1001	5.6	5.6	5.4	5.0	4.9	ARS Calib., reset
SELM	12/05/2000	b	1183	7.5	759	5.4	5.5	5.6	5.0	5.2	ARS Calib., reset
SELM	12/05/2000	c	1133	7.5	759	5.4	5.2	5.4	5.1	5.2	ARS Calib., reset
SELM	12/05/2000	b	997	7.5	759	5.0	5.0	5.1	5.2	5.2	ARS Calib., reset
SELM	12/05/2000	c	1104	7.5	759	4.6	4.6	5.2	4.6	5.2	ARS Calib., reset
SELM	12/15/2000	b	0997	14.6	1013	5.2	5.2	5.3	5.2	5.3	CRPAQS Auditor
SELM	12/15/2000	c	1104	14.6	1013	4.6	4.6	5.1	4.6	5.1	CRPAQS Auditor
SELM	12/15/2000	c	1133	14.6	1013	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditor
SELM	12/15/2000	b	1183	14.6	1013	5.1	5.0	4.9	5.1	4.9	CRPAQS Auditor
SFA	05/25/2000	b	1135	12.2	1006	5.7	5.8	5.9	5.2	5.1	ARS Calib., reset
SFA	05/25/2000	c	1221	12.2	1006	5.6	5.6	5.4	5.1	5.1	ARS Calib., reset
SFA	11/30/2000	c	1221	18.0	1023	NA	4.9	4.9	5.2	5.2	ARS Calib., reset
SFA	11/30/2000	b	1135	18.0	1023	5.2	5.2	5.2	5.2	5.2	ARS Calib., reset
SFE	10/23/2000	h	590	24.2	1006	5.3	5.3	5.2			CRPAQS Auditor
SFE	10/23/2000	h	590	24.2	1006				5.3	5.0	Set By Auditor
SFE	10/23/2000	g	1131	24.2	1006	5.3	5.3	5.2	5.3	5.2	CRPAQS Audiitor
SFE	10/23/2000	i	1009	24.2	1006	5.4	5.6	4.6			CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found Indicated Set Point	As Found MiniVol Flow (lpm)	As Found Reference Flow (lpm)	Left As Indicated Set Point	Left As Reference Flow (lpm)	Comments
SFE	10/23/2000	i	1009	24.2	1006				5.4	5.0	Set By Auditor
SJ4	05/25/2000	d	1315	23.0	1010	5.5	5.6	5.5	5.1	5.1	ARS Calib., reset
SJ4	11/30/2000	d	1315	19.0	1019	5.1	5.1	5.1	5.2	5.2	ARS Calib., reset
SNFH	05/24/2000	b	1171	29.4	945	5.5	5.4	5.5	4.8	4.8	ARS Calib., reset
SNFH	12/07/2000	b	1017	12.2	711	5.3	5.3	5.3	5.0	5.0	ARS Calib., reset
SNFH	12/07/2000	b	1171	12.2	711	4.8	4.8	5.0	5.0	5.0	ARS Calib., reset
SNFH	12/07/2000	c	1205	12.2	711	5.3	5.2	5.2	5.0	5.0	ARS Calib., reset
SOH	05/23/2000	b	1103	30.0	1010	5.8	5.9	5.6	5.2	5.0	ARS Calib., reset
SOH	05/23/2000	c	1335	30.0	1010	5.4	5.8	5.6	5.0	5.0	ARS Calib., reset
SOH	12/01/2000	c	1008	13.0	1022	5.4	5.4	5.4	5.2	5.2	ARS Calib., reset
SOH	12/01/2000	b	1131	13.0	1022	5.3	5.3	5.3	5.2	5.2	ARS Calib., reset
SOH	12/01/2000	b	1196	13.0	1022	5.4	5.2	5.4	5.2	5.2	ARS Calib., reset
SOH	12/01/2000	c	1335	13.0	1022	4.6	4.6	4.6	5.2	5.2	ARS Calib., reset
SOH	12/13/200	c	1335	13.0	1016	5.1	5.1	5.1	5.1	5.1	CRPAQS Auditor
SOH	12/13/2000	b	1196	13.0	1016	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
SOH	12/13/2000	c	1008	13.0	1016	5.1	5.2	5.0	5.1	5.0	CRPAQS Auditor
SOH	12/13/2000	b	1131	13.0	1016	5.1	5.1	5.0	5.1	5.0	CRPAQS Auditor
SWC	05/25/2000	c	1259	39.0	1003	5.6	5.6	5.6	5.0	5.0	ARS Calib., reset
SWC	05/25/2000	b	1314	39.0	1003	5.7	5.7	5.6	5.0	5.0	ARS Calib., reset
SWC	12/06/2000	c	597	10.7	764	NA	5.4	5.6	5.0	5.2	ARS Calib., reset
SWC	12/06/2000	c	1176	10.7	764	5.3	5.3	5.4	5.2	5.2	ARS Calib., reset
SWC	12/06/2000	b	1105	10.7	764	5.4	5.4	5.5		5.2	ARS Calib., reset
SWC	12/06/2000	b	1314	10.7	764	5.2	5.3	5.4	5.2	5.2	ARS Calib., reset
SWC	12/14/2000	b	1314	15.7	1019	5.1	5.1	4.9	5.1	4.9	CRPAQS Auditor
SWC	12/14/2000	c	597	15.7	1019	5.0	5.0	4.9	5.0	4.9	CRPAQS Auditor
SWC	12/14/2000	b	1105	15.7	1019	5.2	5.2	5.3	5.2	5.3	CRPAQS Auditor
SWC	12/14/2000	c	1176	15.7	1019	5.2	5.2	5.1	5.2	5.1	CRPAQS Auditor
TEH2	06/02/2000	b	1197	27.0	880	5.2	5.2	5.0	4.7	4.7	ARS Calib., reset
TEH2	12/07/2000	b	1197	11.0	879	4.7	4.6	4.5	4.9	4.8	ARS Calib., reset
TEH2	12/07/2000	b	1323	11.0	879	5.4	5.7	5.7	4.9	4.8	ARS Calib., reset
TEH2	01/12/2001	b	1323	3.6	870	4.9	NA	5.3	4.9	5.3	CRPAQS Auditor

Appendix E – MiniVol Calibration Data and Set Point Summary

Location	Date	Filter[1] Type	Sampler S/N	Amb. Temp (C)	Amb. Prs. (mb)	As Found: Indicated Set Point	As Found: MiniVol Flow (lpm)	As Found: Reference Flow (lpm)	Left As: Indicated Set Point	Left As: Reference Flow (lpm)	Comments
TEH2	01/12/2001	b	1197	3.6	870	4.9	4.9	5.0	4.9	5.0	CRPAQS Auditor
VCS	05/30/2000	h	1206	30.0	999	5.3	5.3	5.1	5.1	4.9	ARS Calib., reset
VCS	05/30/2000	g	1130	30.0	999	5.3	5.4	5.2	5.1	4.9	ARS Calib., reset
VCS	05/30/2000	b	1336	30.0	999	5.7	5.7	5.6	5.0	4.9	ARS Calib., reset
VCS	05/30/2000	c	1330	30.0	999	5.3	5.3	5.2	5.0	4.9	ARS Calib., reset
VCS	12/04/2000	h	1206	9.1	757	5.1	5.0	5.2	5.2	5.2	ARS Calib., reset
VCS	12/04/2000	c	1330	9.1	757	5.0	5.3	5.3	5.2	5.2	ARS Calib., reset
VCS	12/04/2000	b	1336	9.1	757	5.0	4.6	4.8	5.2	5.2	ARS Calib., reset
VCS	12/04/2000	g	1130	9.1	757	5.1	4.9	5.0	5.2	5.2	ARS Calib., reset
YOD	10/24/2000	g	1208	21.1	1013	5.4	5.5	5.2	5.4	5.2	CRPAQS Auditor
YOSE	05/25/2000	d	1320	21.1	836	5.1	5.2	5.1	4.7	4.6	ARS Calib., reset
YOSE	12/08/2000	d	1320	6.5	840	4.7	4.7	4.6	4.7	4.8	ARS Calib., reset

Note 1 DRI Filter Designations		CRAPAQS Integrated Database Filter Designations		DesigNAtion Descriptions
FTC	(b type)	TCC	$PM_{2.5}$	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
FQN	(c type)	QNC	$PM_{2.5}$	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.
TTC	(g type)	TCC	PM_{10}	Teflon-membrane and citric-acid impregnated cellulose-fiber filters.
TQN	(h type)	QNC	PM_{10}	Quartz-fiber and sodium -chloride-impregnated cellulose-fiber filters.
GIF	(d type)	TIG	$PM_{2.5}$	Teflon impregnated glass fiber filters for organic speciation
TPN	(I type)	TIG	PM_{10}	Teflon impregnated Nuclepore glass filters for organic speciation.

APPENDIX F

NEPHELOMETER CALIBRATION DATA

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
ACP	305	12/08/00	1445	297	38	961	0.01	8.15	7.71	1.06	ARS calibration
ACP	305	12/08/00	1500	297	38	961	0.01	7.67	7.73	0.99	ARS calib., reset
ACP	305	02/06/01	1210	290	37	961	0.07	8.24	8.09	1.02	
ALT1	233	03/17/00	1540	298	21	970	0.02	7.83	8.00	0.98	
ALT1	233	04/01/00	1600	305	17	970	-0.01	7.35	7.59	0.97	
ALT1	233	04/15/00	1305	289	59	970	0.08	8.30	8.09	1.03	
ALT1	233	05/23/00	1100	307	32	970	0.00	7.39	7.53	0.98	ARS calibration
ALT1	233	06/10/00	1500	294	36	970	0.09	7.94	7.92	1.00	CRPAQS Audit
ALT1	233	07/21/00	1600	298	43	970	0.12	7.91	7.88	1.00	
ALT1	233	09/13/00	1445	310	14	970	0.08	7.10	7.47	0.95	
ALT1	233	12/01/00	0730	282	71	970	0.37	8.59	8.34	1.02	ARS calibration
ALT1	233	12/01/00	0800	282	71	970	0.00	8.39	8.37	1.00	ARS calib., reset
ALT1	233	12/16/00	1120	288	51	970	0.11	7.92	8.14	0.97	CRPAQS Audit
ALT1	233	02/08/01	1415	290	17	970	-0.21	7.76	8.07	0.96	
ANG LAB	229	10/08/00	1730	296	51	1001	-0.31	6.83	8.17	0.84	
ANG LAB	234	10/24/00	1131	295	32	1001	-0.03	8.40	8.26	1.02	
ANG LAB	247	10/13/00	1351	295	47	1001	0.28	8.12	8.12	1.00	
ANG LAB	248	10/09/00	1132	295	50	1001	0.31	8.65	8.19	1.06	
ANG LAB	249	10/09/00	1632	297	45	1001	0.42	8.66	8.17	1.06	
ANG LAB	261	10/09/00	1847	296	40	1001	0.28	8.31	8.22	1.01	
ANG LAB	264	10/07/00	1537	296	44	1001	0.02	8.07	8.21	0.98	
ANG LAB	270	10/07/00	1646	297	47	1001	0.02	8.46	8.18	1.03	
ANG LAB	272	10/08/00	0821	295	39	1001	-0.06	8.33	8.20	1.02	
ANG LAB	273	10/09/00	1802	296	41	1001	0.03	7.97	8.20	0.97	
ANG LAB	275	10/07/00	1842	296	44	1001	0.02	7.84	8.16	0.96	
ANG LAB	276	10/07/00	1946	296	43	1001	0.12	8.30	8.17	1.02	
ANG LAB	277	10/09/00	1437	296	43	1001	0.03	7.70	8.17	0.94	
ANG LAB	278	10/07/00	2132	295	42	1001	0.19	8.61	8.20	1.05	
ANG LAB	290	10/07/00	1751	296	46	1001	0.08	8.49	8.19	1.04	
ANG LAB	292	10/09/00	1341	296	42	1001	-0.01	7.58	8.21	0.92	

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
ANG LAB	300	10/07/00	1430	297	44	1001	0.03	6.89	8.30	0.83	
ANG LAB	301	10/07/00	1156	297	42	1001	0.03	8.21	8.30	0.99	
ANG LAB	302	10/07/00	2046	296	39	1001	0.01	7.74	8.18	0.95	
ANG LAB	303	10/06/00	1412	297	45	1001	0.01	8.16	8.25	0.99	
ANG LAB	304	10/07/00	1108	296	42	1001	-0.05	7.46	8.30	0.90	
ANG LAB	305	10/06/00	1245	297	46	1001	0.05	8.25	8.28	1.00	
ANG LAB	306	10/24/00	1002	294	31	1001	0.04	8.15	8.28	0.98	
ANG LAB	306	10/07/00	1023	295	43	1001	0.03	7.86	8.32	0.94	
ANG LAB	307	10/17/00	1556	297	46	1001	-0.02	7.64	8.14	0.94	
ANG LAB	308	10/17/00	1701	296	46	1001	0.02	8.47	8.19	1.03	
ANG test	227	02/09/01	1421	291	34	1013	-0.05	8.58	8.50	1.01	
ANG test	262	02/09/01	1521	291	41	1013	0.51	9.22	8.46	1.09	
ANG test	292	02/09/01	1742	287	49	1013	0.41	8.74	8.56	1.02	
ANG test	305	02/09/01	1643	288	52	1013	0.04	8.84	8.55	1.03	
ANG test	312	02/09/01	1315	289	31	1013	-0.12	8.36	8.59	0.97	
BAR	271	07/12/00	0930	305	12	1013	-0.23	6.58	7.99	0.82	
BAR	271	08/04/00	0830	307	20	948	0.15	6.24	7.36	0.85	
BAR	271	08/28/00	1030	305	20	948	-0.80	6.45	7.38	0.87	
BAR	271	10/27/00	1205	298	30	948	0.01	7.14	7.74	0.92	
BAR	271	12/08/00	0848	283	53	948	0.07	7.75	7.99	0.97	ARS calibration
BAR	271	12/08/00	0910	283	53	936	0.02	7.83	7.90	0.99	ARS calib., reset
BAR	271	02/02/01	1400	296	12	936	-0.01	7.44	7.58	0.98	
BELL	276	10/25/00	0755	290	44	1001	0.16	8.69	8.39	1.04	CRPAQS Audit
BODB	194	02/17/00	1215	292	67	1017	0.08	8.95	8.71	1.03	
BODB	194	03/03/00	1600	291	71	1011	0.09	8.80	8.72	1.01	
BODB	194	05/10/00	1300	288	70	1015	0.05	8.73	8.80	0.99	
BQUC	274	07/12/00	1650	304	9	928	-0.09	6.87	8.00	0.86	
BQUC	274	08/04/00	1425	308	14	928	-0.05	6.84	7.11	0.96	
BQUC	274	08/28/00	1710	300	41	928	-0.06	6.94	7.34	0.95	CRPAQS Audit
BRES	300	12/04/00	1445	284	76	1001	0.17	7.98	8.61	0.93	ARS calibration

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
BRES	300	12/04/00	1530	284	76	995	0.01	8.54	8.55	1.00	ARS calib., reset
BRES	300	02/06/01	1620	296	37	995	0.06	7.74	8.09	0.96	
BTI	248	03/17/00	1720	296	38	1013	-0.02	8.07	8.33	0.97	
BTI	248	04/03/00	1430	300	36	1013	-0.03	7.95	8.17	0.97	
BTI	248	04/15/00	1525	293	46	1013	0.06	8.46	8.39	1.01	
BTI	248	05/15/00	1520	292	48	1013	0.06	8.39	8.42	1.00	
BTI	248	05/23/00	1426	312	23	1013	0.02	7.60	7.84	0.97	ARS calibration
BTI	248	06/06/ 00	1648	299	NA	1011	0.05	8.07	8.14	0.99	CRPAQS Audit
BTI	248	07/21/00	1810	302	35	1011	0.12	8.16	8.07	1.01	
BTI	248	09/14/00	1545	300	53	1011	0.19	8.20	8.15	1.01	
BTI	311	11/30/00	0903	287	69	1013	0.83	7.26	8.62	0.84	ARS calibration
BTI	311	11/30/00	0922	287	69	1011	0.01	8.62	8.62	1.00	ARS calib., reset
BTI	311	12/05/00	1310	284	79	1011	0.02	8.46	8.54	0.99	CRPAQS Audit
BTI	311	01/12/01	1510	288	52	1011	-0.01	8.23	8.48	0.97	
BTI	311	02/10/01	1530	288	46	1011	-0.03	8.19	8.47	0.97	
CAJP	277	08/04/00	1005	307	16	867	-0.03	6.23	7.92	0.79	
CAJP	277	08/28/00	1300	301	42	867	0.00	6.45	6.75	0.96	CRPAQS Audit
CANT	276	08/04/00	0625	302	30	928	0.02	7.26	7.38	0.98	
CANT	276	08/28/00	0800	299	25	928	0.01	7.51	7.38	1.02	CRPAQS Audit
CANT	276	07/11/00	1400	311	7	928	-0.04	6.91	7.76	0.89	
CANL	234	11/15/00	1352	287	48	1001	0.02	9.03	8.48	1.06	
CARP	261	07/07/00	1330	303	15	967	-0.02	7.51	7.68	0.98	
CARP	261	08/12/00	1100	311	12	967	0.02	6.93	7.43	0.93	
CARP	261	10/01/00	1540	308	16	967	0.12	7.26	7.46	0.97	
CARP	308	12/06/00	0645	279	46	1001	0.03	8.74	8.77	0.99	ARS calibration
CARP	308	12/06/00	0715	279	46	941	-0.01	8.15	8.13	1.00	ARS calib., reset
CARP	308	01/01/01	1445	288	46	1013	-0.04	9.10	8.65	1.05	CRPAQS Audit
CARP	308	02/01/01	1300	297	12	941	-0.01	7.35	7.55	0.97	
CHLV	237	03/10/00	1315	296	20	882	0.04	7.38	7.05	1.05	
CHLV	237	03/24/00	1310	299	14	882	0.02	8.33	6.96	1.19	

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
CHLV	237	04/21/00	1335	303	13	882	0.02	6.82	6.84	1.00	
CHLV	237	05/04/00	1200	308	10	882	0.00	6.69	6.73	0.99	
CHLV	237	06/02/00	NA	308	5	935	-0.11	7.46	7.01	1.06	ARS calib., reset press.
CHLV	237	06/15/00	1030	313	7	935	0.00	6.54	7.08	0.93	CRPAQS Audit
CHLV	237	07/18/00	1150	312	4	935	0.15	6.38	7.07	0.90	
CHLV	237	08/23/00	1110	307	11	935	0.11	6.80	7.25	0.94	
CHLV	237	12/07/00	1318	296	13	935	0.22	7.23	7.48	0.97	ARS calibration
CHLV	237	12/07/00	1345	296	13	935	0.02	7.54	7.58	1.00	ARS calib., reset
CHLV	237	01/12/01	1500	285	57	1013	0.14	8.23	8.01	1.03	CRPAQS Audit
CLO	249	12/07/00	1238	294	29	1001	0.39	8.82	8.29	1.06	ARS calibration
CLO	249	12/07/00	1250	294	29	1001	0.01	8.29	8.28	1.00	ARS calib., reset
CLO	249	12/15/00	0820	287	70	1001	0.21	8.72	8.46	1.03	CRPAQS Audit
CLO	249	02/13/01	1356	285	58	1001	0.21	8.90	8.53	1.04	
CO5	292	10/24/00	0927	294	30	1001	0.01	7.78	8.24	0.94	CRPAQS Audit
COP	274	10/23/00	0915	289	48	1001	0.23	8.82	8.52	1.04	CRPAQS Audit
COP	274	12/01/00	1120	282	72	1008	0.43	9.77	8.73	1.12	ARS calibration
COP	274	12/01/00	1200	282	72	1001	0.05	8.65	8.68	1.00	ARS calib., reset
COP	274	02/20/01	1001	287	62	1001	0.12	8.57	8.40	1.02	
COPE	290	10/24/00	1352	303	16	1001	0.10	8.43	7.95	1.06	CRPAQS Audit
COPE	290	11/16/00	1038	285	50	1001	0.27	9.58	8.59	1.12	
COPN	305	10/24/00	1439	305	16	1001	0.04	7.79	7.85	0.99	CRPAQS Audit
COPN	305	11/15/00	1536	290	41	1001	0.11	8.75	8.34	1.05	
COPS	303	10/25/00	0712	286	54	1001	0.06	8.67	8.48	1.02	CRPAQS Audit
COPS	303	11/16/00	0845	284	52	1001	0.12	9.18	8.65	1.06	
COPW	272	10/24/00	1528	305	16	1001	0.02	8.05	7.88	1.02	CRPAQS Audit
COPW	272	11/15/00	1656	286	52	1001	0.07	9.15	8.48	1.08	
COV1	304	10/24/00	1141	301	NA	1001	-0.04	7.15	7.99	0.89	CRPAQS Audit
CRLD	275	12/01/00	1322	288	62	1001	0.21	8.49	8.41	1.01	
CRLD	275	12/01/00	1341	288	62	1007	0.01	8.48	8.46	1.01	
CRLD	290	05/14/00				1001	-0.09	8.11		1.00	

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
CRLD	290	08/09/00	1230	303	34	1001	-0.09	8.02	7.99	1.00	
CRLD	290	08/17/00	0805	297	44	1001	-0.08	8.20	8.17	1.00	
CRLD	290	08/25/00	1235	306	26	1001	-0.02	7.80	7.87	0.99	
CRLD	290	09/05/00	1105	297	32	1001	-0.02	8.41	8.15	1.03	
DAIP	264	10/23/00	1118	297	28	1001	1.95	6.18	8.19	0.75	CRPAQS Audit
DAIU	308	10/23/00	1222	298	27	1001	0.02	8.12	8.11	1.00	CRPAQS Audit
DUB1	229	01/29/00	1515	293	46	970	0.01	8.18	8.19	1.00	
DUB1	229	03/17/00	1315	300	23	970	-0.14	7.42	7.86	0.94	
DUB1	229	04/01/00	1315	303	18	970	-0.18	7.01	7.57	0.93	
DUB1	229	05/26/00	0807	286	38	970	0.13	7.53	8.17	0.92	ARS calibration
DUB1	229	06/10/00	1113	292	51	970	-0.18	7.37	7.98	0.92	
DUB1	229	08/05/00	1110	298	44	970	-0.23	7.28	7.78	0.94	
DUB1	229	09/13/00	1215	308	21	970	-0.33	6.25	7.50	0.83	
DUB1	261	12/16/00	1310	296	26	995	-0.19	7.78	8.10	0.96	CRPAQS Audit
DUB1	261	02/22/01	1600	290	53	995	-0.05	8.40	8.34	1.01	
EDI	234	01/11/01	1030	290	48	992	0.06	8.57	8.28	1.03	CRPAQS Audit
EDI	234	02/06/01	1255	295	46	992	0.07	8.24	8.08	1.02	
EDW	235	02/22/00	1530	286	54	840	0.08	8.27	7.60	1.09	
EDW	235	03/10/00	1730	294	19	840	-0.06	7.95	7.57	1.05	
EDW	235	04/05/00	1230	303	12	915	-0.10	7.37	7.13	1.03	
EDW	235	04/21/00	1045	295	24	915	0.05	7.50	7.39	1.01	
EDW	235	05/04/00	1515	305	20	915	-0.09	7.09	7.08	1.00	
EDW	235	06/02/00	1530	306	10	932	-0.05	7.11	7.06	1.01	ARS calib., reset press.
EDW	235	06/15/00	1330	316	10	932	-0.15	6.74	6.94	0.97	CRPAQS Audit
EDW	235	07/18/00	1110	310	9	932	-0.04	6.89	7.10	0.97	
EDW	235	08/23/00	1400	312	9	932	-0.11	6.79	7.04	0.96	
EDW	235	10/26/00	1555	287	53	932	0.07	7.85	7.72	1.02	
EDW	235	02/01/01	1140	290	21	932	0.04	8.08	7.81	1.03	
FEDL	270	07/06/00	1255	307	28	1001	0.33	7.58	7.80	0.97	
FEDL	270	07/16/00	1425	310	19	1001	0.56	9.65	7.72	1.25	Neph very dirty

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
FEDL	270	07/25/00	1305	315	14	1001	0.92	11.01	7.60	1.45	Neph very dirty
FEDL	270	08/04/00	1130	311	29	1001	1.37	11.83	7.70	1.54	Neph very dirty
FEDL	292	08/10/00	1535	315	16	1001	-0.10	7.03	7.68	0.92	
FEDL	292	08/15/00	1735	313	21	1001	0.03	7.74	7.69	1.01	
FEDL	292	08/26/00	0920	305	28	1001	0.45	9.05	7.91	1.14	
FEDL	292	01/08/01	1420	288	66	1001	0.40	7.14	8.41	0.85	CRPAQS Audit
FEDL	292	02/09/01	0911	292	53	1001	0.48	8.58	8.52	1.01	
FEDL	294	08/26/00	1045	309	23	1001	-0.05	7.75	7.78	1.00	
FEDL	294	09/07/00	1050	307	21	1001	0.19	8.64	7.85	1.10	
FEL	234	02/07/00	1830	292	45	838	0.18	7.89	8.20	0.96	
FEL	234	02/19/00	1210	289	45	838	0.19	7.96	8.18	0.97	ARS calibration
FEL	234	03/15/00	1740	294	33	977	-0.03	7.81	7.85	1.00	CRPAQS Audit
FEL	234	04/14/00	1320	305	19	977	-0.05	7.32	7.66	0.96	
FEL	234	05/07/00	1625	298	35	977	-0.01	7.64	7.83	0.98	
FEL	234	05/27/00	1230	307	23	977	0.02	7.15	7.61	0.94	CRPAQS Audit
FEL	234	05/31/00	1425	303	17	977	-0.03	7.18	7.71	0.93	
FEL	234	06/12/00	1325	306	21	977	0.06	7.24	7.61	0.95	
FEL	234	07/07/00	1100	303	25	977	0.17	7.22	7.69	0.94	
FEL	234	08/12/00	1350	312	15	977	0.11	7.07	7.42	0.95	
FEL	290	01/09/01	1345	296	35	977	0.00	7.21	7.99	0.90	
FEL	290	02/07/01	1130	288	29	977	0.04	8.12	8.30	0.98	
FEL	307	01/09/01	0920	285	72	951	0.14	7.68	8.10	0.95	
FEL	307	07/07/01	1250	281	45	951	0.06	8.39	8.19	1.02	
FELF	249	04/14/00	1430	303	21	972	-0.14	7.35	7.65	0.96	
FELF	249	05/07/00	1520	298	34	972	-0.02	7.46	7.82	0.96	ARS calibration
FELF	249	05/27/00	1300	306	25	972	0.01	7.20	7.61	0.95	CRPAQS Audit
FELF	249	05/31/00	1230	299	21	972	-0.02	7.30	7.76	0.94	
FELF	249	06/12/00	1207	303	25	972	-0.04	7.34	7.68	0.96	
FELF	249	07/07/00	0945	301	29	972	0.00	7.51	7.52	1.00	CRPAQS Audit
FELF	249	08/12/00	1455	310	17	972	0.13	7.20	7.44	0.97	

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
FREM	211	02/04/00	1410	296	49	1001	0.92	8.69	8.09	1.07	
FREM	211	02/20/00	1520	298	46	1001	0.00	8.44	8.08	1.04	
FREM	211	04/02/00	1330	306	16	1001	-0.05	8.04	7.87	1.02	
FREM	211	05/30/00	0905	300	33	1001	0.08	7.94	8.04	0.99	ARS calibration
FREM	211	07/20/00	1625	313	17	1001	0.03	7.40	7.65	0.97	
FREM	211	09/04/00	1030	300	30	1001	0.18	8.22	8.05	1.02	
FREM	211	12/15/00	1400	295	59	1001	-0.23	8.26	8.19	1.01	CRPAQS Audit
FREM	211	02/14/01	1132	291	47	1001	-0.19	8.57	8.31	1.03	
FRES	230	02/09/00	1425	298	40	1001	-0.02	7.91	8.04	0.98	
FRES	230	02/23/00	1450	294	29	1001	-0.01	8.36	8.29	1.01	
FRES	230	04/02/00	1505	308	12	1001	0.02	7.69	7.80	0.99	
FRES	230	05/29/00	1130	303	17	1001	0.08	7.58	7.55	1.00	ARS calibration
FRES	230	07/20/00	1800	310	21	1001	0.03	7.42	7.78	0.95	
FRES	230	09/04/00	1225	302	25	1001	0.24	7.83	8.08	0.97	
FRES	230	12/15/00	1150	296	35	1001	-0.03	7.79	8.20	0.95	CRPAQS Audit
FRES	230	02/14/01	0951	288	47	1001	-0.04	8.05	8.40	0.96	
GRA	275	10/23/00	1723	295	32	1001	0.07	8.01	8.13	0.99	CRPAQS Audit
GRA	275	11/16/00	1321	294	30	1001	0.13	8.25	8.31	0.99	
GRAE	277	10/25/00	0911	294	33	1001	0.08	8.16	8.23	0.99	CRPAQS Audit
GRAN	270	10/25/00	0834	291	41	1001	0.05	8.94	8.34	1.07	CRPAQS Audit
GRAN	270	11/15/00	1700	285	53	1001	0.15	9.49	8.54	1.11	
GRAS	301	10/24/00	1010	298	25	1001	0.05	8.06	8.14	0.99	CRPAQS Audit
GRAS	301	11/16/00	1433	291	32	1001	0.09	8.91	8.36	1.07	
GRAW	300	10/24/00	1103	300	20	1001	-0.05	6.95	8.05	0.86	CRPAQS Audit
H43	302	10/23/00	1330	302	18	1001	0.05	7.35	7.97	0.92	CRPAQS Audit
HAN	229	10/24/00	0720	286	58	1001	0.29	7.67	8.50	0.90	CRPAQS Audit
HAN	229	11/15/00	0925	281	70	1001	-0.27	7.48	8.67	0.86	
HAN LAB	247	11/16/00	2107	298	29	1001	0.33	8.05	8.11	0.99	
HAN LAB	248	11/16/00	0811	293	38	1001	0.29	8.58	8.24	1.04	
HAN LAB	261	11/15/00	0838	292	35	1001	0.38	8.84	8.25	1.07	

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
HAN LAB	277	11/17/00	1307	291	37	1001	0.39	8.12	8.33	0.97	
HAN LAB	278	11/16/00	1849	291	31	1001	0.31	8.56	8.13	1.05	
HAN LAB	292	11/16/00	2202	297	28	1001	0.05	7.93	8.19	0.97	
HAN LAB	300	11/16/00	1741	293	33	1001	0.25	7.16	7.35	0.97	
HAN LAB	302	11/17/00	0910	293	35	1001	0.04	7.88	8.21	0.96	
HAN LAB	304	11/17/00	1228	289	42	1001	0.09	8.18	8.37	0.98	
HAN LAB	307	11/16/00	2059	296	31	1001	0.03	7.50	8.14	0.92	
HAN LAB	308	11/17/00	0720	294	39	1001	0.03	8.69	8.22	1.06	
HELM	264	02/13/01	0931	282	67	1001	0.01	8.29	8.63	0.96	
KCW	229	12/04/00	0845	285	71	1001	0.03	7.15	8.56	0.84	ARS calibration
KCW	229	12/04/01	0908	285	71	1001	0.03	8.53	8.53	1.00	ARS calib., reset
KCW	229	01/10/01	1230	287	74	1001	0.07	8.25	8.43	0.98	CRPAQS Audit
KCW	229	02/01/01	1545	294	36	1001	0.05	7.96	8.21	0.97	
KRV	247	03/16/00	1345	295	45	950	0.01	7.67	7.70	1.00	
KRV	247	03/23/00	1351	298	24	950	0.00	7.97	7.64	1.04	
KRV	247	04/04/00	1330	303	27	950	-0.01	7.36	7.46	0.99	
KRV	247	05/24/00	0900	304	34	950	-0.01	7.35	7.35	1.00	ARS calibration
KRV	247	07/20/00	1330	311	19	943	0.08	6.97	7.18	0.97	
KRV	247	09/04/00	1655	300	25	943	0.17	7.33	7.48	0.98	
KRV	312	12/07/00	1446	292	38	943	-0.05	7.56	7.71	0.98	ARS calibration
KRV	312	12/07/00	1505	292	38	943	0.02	7.83	7.81	1.00	ARS calib., reset
KRV	312	02/08/01	1506	292	27	943	-0.08	7.86	7.85	1.00	
LATN	306	11/15/00	1134	281	67	1001	0.11	8.13	8.67	0.94	ARS calibration
LVR1	317	11/30/00	1852	285	66	1013	0.00	8.57	8.67	0.99	CRPAQS Audit
LVR1	317	12/16/00	0940	288	49	1013	0.01	8.12	8.54	0.95	
LVR1	317	02/22/01	1000	287	65	1013	0.01	8.19	8.58	0.95	ARS calibration
M14	301	12/01/00	2104	285	56	1001	0.14	8.70	8.65	1.01	ARS calib., reset
M14	301	12/01/00	2122	285	56	1009	0.01	8.59	8.60	1.00	CRPAQS Audit
M14	301	12/14/00	1000	287	69	1009	-0.08	8.52	8.53	1.00	
M14	301	02/15/01	1357	292	39	1009	-0.13	8.40	8.37	1.00	ARS calibration

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
MRM	212	12/01/00	1500	288	66	1007	0.00	8.54	8.48	1.01	CRPA!QS Audit
MRM	212	12/14/01	1225	288	65	1007	0.10	8.53	8.49	1.01	
MRM	212	02/14/01	1545	291	37	1007	-0.01	8.50	8.39	1.01	
NIL	278	10/24/00	1311	304	17	1001	0.37	7.98	7.93	1.01	CRPAQS Audit
OLD	247	12/06/00	1105	296	23	1001	0.33	8.29	8.34	0.99	ARS calibration
OLD	247	12/06/00	1136	296	23	1001	0.00	8.25	8.26	1.00	ARS calib., reset
OLD	247	01/11/01	0830	286	66	1001	0.22	8.58	8.42	1.02	CRPAQS Audit
OLD	247	02/06/01	1025	291	51	1001	0.14	8.32	8.25	1.01	
OLW	231	03/06/00	1213	279	52	888	-0.01	7.71	7.66	1.01	
OLW	231	03/24/00	1025	293	17	888	-0.04	7.15	7.14	1.00	
OLW	231	04/21/00	1630	300	14	888	0.06	13.54	7.12	1.91	invalid calib.?
OLW	231	04/28/00	1125	300	8	888	-0.01	6.75	6.95	0.97	
OLW	231	05/29/00	1325	312	5	888	0.10	6.32	6.64	0.95	
OLW	231	06/02/00	0918	303	11	888	-0.04	6.94	7.10	0.98	ARS calibration
OLW	231	06/02/00	0930	303	11	88	-0.03	NA	NA	NA	ARS calib., reset zero
OLW	231	06/13/00	0920	304	?	888	0.04	7.49	7.95	0.94	
OLW	231	06/14/00	1215	309	2	888	-0.08	6.32	6.93	0.91	
OLW	231	07/14/00	1150	309	8	888	0.04	6.42	6.94	0.93	
OLW	231	08/23/00	1205	307	7	888	-0.02	6.64	6.99	0.95	
OLW	231	12/07/00	1738	280	29	888	0.05	7.75	7.79	0.99	ARS calibration
OLW	231	12/07/00	1752	280	29	888	0.02	7.74	7.77	1.00	ARS calib., reset
OLW	231	01/12/01	1200	279	66	888	0.07	7.59	7.71	0.98	
OLW	231	02/05/01	1025	290	36	888	0.05	7.34	7.37	1.00	
OTT	247	10/24/00	1706	300	23	1001	0.26	7.76	8.04	0.97	CRPAQS Audit
PAC1	214	02/15/00	1445	288	59	970	0.03	14.23	8.12	1.75	erratic
PAC1	214	03/06/00	1014	290	50	970	-0.07	7.80	8.24	0.95	
PAC1	214	03/21/00	1535	293	32	970	-0.11	7.74	7.95	0.97	
PAC1	214	04/03/00	1413	295	44	970	-0.10	7.34	7.88	0.93	
PAC1	214	05/25/00	1300	291	55	888	0.08	7.13	7.21	0.99	ARS calib., reset press
PAC1	214	06/09/00	0915	290	NA	888	0.17	7.48	7.27	1.03	CRPAQS Audit

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
PAC1	214	07/21/00	1900	294	53	888	0.14	7.62	7.11	1.07	
PAC1	214	09/05/00	1341	299	21	888	0.15	6.93	6.98	0.99	
PAC1	214	12/01/00	1643	283	71	888	0.94	8.03	8.24	0.97	ARS calibration
PAC1	214	12/01/00	1800	283	71	964	0.00	8.27	8.30	1.00	ARS calib., reset
PAC1	214	02/07/01	1715	283	30	964	-0.37	8.33	8.27	1.01	
PIXL	210	02/07/00	1010	285	85	1020	0.06	9.28	8.76	1.06	RH heat?
PIXL	210	02/20/00	1405	295	39	1020	0.06	8.33	8.34	1.00	
PIXL	210	03/02/00	1445	285	82	1013	0.16	9.22	8.61	1.07	RH heat? Press reset
PIXL	210	03/14/00	1115	295	57	1013	0.07	8.46	8.33	1.02	
PIXL	210	04/04/00	0750	291	63	1013	0.05	8.61	8.44	1.02	
PIXL	210	05/02/00	1030	298	46	1013	-0.02	8.03	8.21	0.98	
PIXL	210	05/25/00	0845	300	36	1013	-0.08	7.84	8.14	0.96	
PIXL	210	05/31/00	1835	304	19	1004	-0.11	7.66	7.99	0.96	ARS calib., press reset
PIXL	210	07/08/00	1600	307	23	1004	0.04	7.23	7.87	0.92	
PIXL	210	08/11/00	1000	302	34	1004	0.03	7.98	8.01	1.00	
PIXL	210	10/01/00	1200	310	21	1004	0.12	7.43	7.75	0.96	
PIXL	210	12/06/00	2024	283	74	1004	0.62	9.92	8.63	1.14	ARS calibration
PIXL	210	12/06/00	2051	283	74	1006	0.01	8.59	8.58	1.00	ARS calib., reset
PIXL	210	12/14/00	1020	289	55	1006	0.07	8.06	7.35	1.10	
PIXL	302	01/10/01/	1015	285	73	1006	0.21	8.59	8.62	1.00	CRPAQS Audit
PIXL	302	02/07/01	0820	282	57	1006	0.19	8.57	8.69	0.99	
PLEG	318	11/29/00	1310	290	62	1009	0.04	8.67	8.68	1.00	ARS calibratio
PLEG	318	12/13/00	1100	286	66	1009	0.01	8.80	8.80	1.00	CRPAQS Audit
PLEG	318	02/05/01	1327	293	46	1009	-0.03	8.48	8.66	0.98	
SDP	212	01/05/00	1245	288	26	1020	0.06	8.86	8.79	1.01	
SDP	212	01/27/00	1310	288	73	1020	0.09	8.94	8.64	1.03	
SDP	212	03/27/00	1335	287	63	1020	0.04	8.75	8.66	1.01	
SDP	212	04/14/00	1150	294	45	1020	0.01	8.19	8.40	0.98	
SDP	264	05/22/00	1700	315	17	1020	0.67	5.75	7.59	0.76	ARS calibration
SDP	264	05/22/00	1818	315	17	1006	0.01	7.56	7.80	0.97	ARS cali., reset

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
SDP	264	05/26/00	1400	306	25	1010	0.04	NA	NA	NA	ARS reset zero set
SDP	264	06/06/00	1050	300	NA	1010	-0.26	7.61	8.18	0.93	CRPAQS Audit
SDP	293	09/25/01	1640	310	16	1013	-0.30	6.77	7.86	0.86	
SDP	293	11/29/00	1624	289	64	1013	0.14	7.86	8.57	0.92	ARS calibration
SDP	293	11/29/00	1640	289	64	1010	0.09	8.45	8.55	0.99	ARS calib., reset
SDP	293	02/05/01	1530	297	35	1010	-0.06	8.15	8.19	1.00	
SELM	193	03/16/00	1820	293	41	998	0.07	8.30	8.30	1.00	
SELM	193	03/23/00	1720	299	18	994	-0.01	8.02	8.09	0.99	
SELM	193	04/04/00	1644	306	23	994	0.04	7.60	7.88	0.96	
SELM	263	05/11/00	1700	297	14	1013	0.01	7.59	8.26	0.92	
SELM	263	05/29/00	1344	306	14	1013	-0.10	7.17	7.78	0.92	ARS calibration
SELM	263	07/25/00	1530	314	16	1001	-0.09	8.12	7.74	1.05	
SELM	263	09/04/00	1420	306	18	1001	-0.15	8.32	8.03	1.04	
SELM	263	12/15/00	1630	289	61	1001	-0.58	8.01	8.35	0.96	CRPAQS Audit
SELM	263	02/13/01	1146	284	63	1001	-0.20	8.17	8.53	0.96	
SFA	320	11/30/00	1227	288	68	1013	0.01	8.88	8.53	1.04	ARS calibration
SFA	320	11/30/00	1250	288	68	1011	0.02	8.49	8.48	1.00	ARS calib., reset
SFA	320	02/18/01	1800	290	66	1011	0.01	8.43	8.57	0.98	
SFE	261	10/23/00	1430	299	22	1001	0.25	8.22	8.06	1.02	CRPAQS Audit
SHE	273	10/25/00	0630	285	59	1001	0.04	8.57	8.52	1.01	CRPAQS Audit
SHE	273	11/15/00	1421	295	30	1001	0.02	8.42	8.28	1.02	
SJ4	228	02/13/00	1250	293	66	1011	-0.03	7.36	8.37	0.88	
SJ4	228	02/27/00	1445	290	54	1011	-0.08	7.71	8.44	0.91	
SJ4	228	05/25/00	1537	300	33	1011	0.04	7.27	8.23	0.88	ARS calibration
SJ4	228	07/21/00	1520	299	48	1011	0.07	8.29	8.16	1.02	
SJ4	228	11/30/00	1436	290	63	1011	0.30	7.77	8.45	0.92	ARS calibration
SJ4	228	11/30/00	1456	290	63	1011	0.01	8.48	8.46	1.00	ARS calib., reset
SLD	278	07/12/00	1430	308	11	916	-0.05	6.94	7.94	0.87	
SLD	278	08/04/00	1210	310	15	916	0.06	7.09	6.97	1.02	
SLD	278	08/28/00	1525	307	29	916	0.11	7.15	7.02	1.02	CRPAQS Audit

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
SNFH	227	01/22/00	1700	291	35	838	-0.10	13.60	7.02	1.94	Invalid
SNFH	227	02/20/00	1150	291	44	970	-0.28	8.10	8.25	0.98	
SNFH	227	03/23/00	1135	295	46	970	-0.27	8.53	8.18	1.04	
SNFH	227	04/04/00	1120	300	37	970	-0.27	7.72	8.02	0.96	
SNFH	227	05/24/00	1130	305	39	970	-0.24	7.18	7.55	0.95	ARS calibration
SNFH	227	07/20/00	1050	307	26	943	-0.24	7.00	7.56	0.93	
SNFH	227	09/04/00	1855	295	38	943	-0.12	8.20	7.92	1.04	
SNFH	227	12/07/00	1640	290	57	943	0.10	8.45	8.13	1.04	ARS calibration
SNFH	227	12/07/00	1705	290	57	943	0.01	8.00	8.02	1.00	ARS calib., reset
SNFH	227	02/08/01	1221	286	44	943	0.01	8.06	8.00	1.01	
SOH	303	12/01/00	1029	288	51	1001	0.24	8.99	8.51	1.06	ARS calibration
SOH	303	12/01/00	1046	288	51	1012	0.00	8.54	8.57	1.00	ARS calib., reset
SOH	303	12/13/00	1600	293	32	1012	-0.07	8.35	8.32	1.00	CRPAQS Audit
SOH	303	02/08/01	1620	297	15	1012	-0.03	8.37	8.18	1.02	
SPE	307	10/24/00	1234	302	17	1001	0.05	7.10	7.97	0.89	CRPAQS Audit
SWC	304	12/06/00	1415	285	67	1001	0.40	8.65	8.53	1.01	ARS calibration
SWC	304	12/06/00	1440	285	67	1001	0.02	8.46	8.48	1.00	ARS calib., reset
SWC	304	12/14/00	1410	290	64	1001	-0.05	8.34	8.36	1.00	CRPAQS Audit
SWC	304	02/12/01	1452	283	50	1001	0.02	8.35	8.38	1.00	
TEH2	232	02/22/00	1800	281	70	838	0.03	7.37	7.09	1.04	
TEH2	232	04/05/00	0955	291	51	877	-0.03	6.73	7.10	0.95	
TEH2	232	04/21/00	0740	284	87	872	0.05	45.00	7.31	6.16	Invalid?
TEH2	232	04/29/00	1240	287	47	872	0.02	7.10	7.18	0.99	
TEH2	232	05/29/00	1735	297	25	872	0.17	10.50	6.91	1.52	Invalid?
TEH2	232	06/02/00	1800	299	19	872	0.02	6.53	6.87	0.95	ARS calibration
TEH2	232	06/14/01	1522	308	NA	872	0.03	6.17	6.62	0.93	CRPAQS Audit
TEH2	232	07/14/00	1857	298	37	872	0.10	6.51	6.86	0.95	
TEH2	232	08/23/00	1630	303	23	872	0.21	6.27	6.73	0.93	
TEH2	232	10/26/00	2000	284	48	872	0.42	7.40	7.28	1.02	
TEH2	232	12/07/01	1919	286	50	872	0.41	7.14	7.19	0.99	ARS calibration

Appendix F – Nephelometer Calibration Data

Calibration Location	Neph S/N	Date	Time (PST)	Neph Temp (K)	Neph RH (%)	Press Set (mb)	b_{scat} Zero	b_{scat} Suva	Cal. Gas	Slope (Suva/Cal)	Comments
TEH2	232	12/07/00	1944	286	50	872	0.01	7.37	7.36	1.00	ARS calib., reset
TEH2	232	01/12/01	0900	278	69	872	0.08	7.74	7.64	1.01	CRPAQS Audit
TEH2	232	02/02/01	1605	288	51	872	0.03	7.29	7.34	0.99	
TEJ	236	02/28/00	1435	281	69	840	0.08	7.69	7.05	1.09	
TEJ	236	04/19/00	0915	286	68	960	0.03	7.76	8.07	0.96	
TEJ	236	04/29/00	1600	295	32	960	0.06	7.09	7.87	0.90	
TEJ	236	05/12/00	1740	293	25	960	0.04	7.49	7.83	0.96	
TEJ	236	06/01/00	1538	303	19	960	-0.07	6.77	7.52	0.90	ARS calibration
TEJ	236	06/01/00	1600	305	19	906	-0.08	7.23	7.14	1.01	ARS calib., reset
TEJ	236	06/14/00	1813	306	17	906	0.05	7.20	7.08	1.02	CRPAQS Audit, reset
TEJ	236	07/11/00	0955	300	37	906	0.18	7.52	7.23	1.04	
TEJ	236	08/04/00	1530	309	23	906	0.20	7.48	7.04	1.06	
TEJ	236	08/28/00	1730	302	35	906	0.38	7.53	7.20	1.05	
TEJ	236	09/28/01	1222	295	52	906	0.57	7.75	7.41	1.04	
TEJ	236	12/05/00	0827	290	20	906	0.66	8.26	7.52	1.09	ARS calibration
TEJ	236	12/05/00	0922	290	20	906	0.01	7.50	7.49	1.00	ARS calib., reset
TEJ	236	02/01/01	0935	257	21	906	0.03	7.93	7.66	1.03	
VCS	270	12/04/00	1505	284	71	1001	0.24	9.64	8.60	1.12	ARS calibration
VCS	270	12/04/00	1535	284	71	1001	0.04	8.50	8.57	0.99	ARS calib., reset
VCS	270	02/10/01	1525	288	51	1001	0.01	8.28	8.39	0.99	
WAG	291	08/15/00	0930	297	47	1001	-0.05	8.30	8.15	1.02	
WAG	291	08/22/00	1535	304	32	1001	-0.16	7.57	7.94	0.95	
WAG	291	09/11/00	1500	307	19	1001	-0.17	7.31	7.86	0.93	
WAG	291	10/03/00	1315	300	35	1001	-0.14	7.64	8.04	0.95	
WAG	291	11/02/00	1545	294	53	1001	-0.06	8.13	8.26	0.98	
WAG	291	12/08/00	0910	286	55	1001	0.06	8.60	8.53	1.01	
WLKP	275	07/11/00	1550	312	5	859	-0.05	6.39	7.78	0.82	
WLKP	275	08/04/00	0500	292	53	859	-0.02	7.18	6.94	1.03	
WLKP	275	08/28/00	0620	291	41	859	-0.01	7.07	6.95	1.02	
YOD	248	10/24/00	0837	291	49	1001	0.23	8.16	8.33	0.98	CRPAQS Audit
YOD	276	11/15/00	1558	287	45	1001	0.23	9.23	8.45	1.09	